CANADIAN MACHINERY
AND
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THE first sheet mill in Canada to operate successfully was installed a few months ago by the Steel Company of Canada, Ltd., at its Hamilton, Ont., plant. This is one of the most important developments in the iron and steel industry in Canada that has taken place in some time, and one that has been even more successful than the management anticipated. Until quite recently all black sheets used in Canada were imported from Great Britain or the United States. It was evident that there was room in Canada for a sheet mill if operated under practical conditions.

A few years ago a sheet mill was installed at Morrisburg, Ont., but for many reasons the proposition was not a success, and the plant lay idle for some time. Last year the Steel Company of Canada, seeing an opportunity for developing its activities and increasing its already wide range of products, purchased the plant at Morrisburg, and installed it, together with important additions, at Hamilton. The entire plant was removed to Hamilton, including mill, furnaces, machinery, and buildings. The plant as reconstructed is one of the most modern and up-to-date sheet mills on this continent. The first sheet was rolled on January 16, 1918, and galvanized the same day by the Dominion Sheet Metal Co., of Hamilton.

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Historical Sketch of Sheet Industry

To digress, a brief history of the steel sheet industry will be interesting as it shows its importance which is growing every year. The demand for steel sheets has increased to such an extent that the supply for some time has been short of requirements. The necessity of sheet iron or steel for so many products, not until more recent years made from this material, is becoming more and more apparent. The growing demand is due largely to the growing scarcity of lumber and also because of the fire resisting qualities of steel sheets. The variety of purposes for which steel sheets are used are too numerous to mention, the building, galvanizing and automobile industries alone require a large tonnage every year. Mill construction and method of manufacture have changed considerably since the early days of the industry. Efficiency in operation and a superior product has resulted from the more modern conditions surrounding the manufacture of steel sheets.

In ancient days the production of thin sheets of iron was accomplished by a very laborious process. Pieces of wrought iron were heated in blacksmith fires and hammered flat and as thin as possible on an anvil. Then several pieces were piled on top of each other, reheated to a red heat, and again hammered until the several layers had reached the required thickness. Naturally sheets of small dimensions only could be produced in this manner. Later the crocodile or helve hammer, driven by water power, came to ease the hard manual labor of the smith.

The process of rolling sheets was invented in England in the eighteenth century. This was a marked step advance in that it not only produced sheets of more uniform thickness, more pliable and of larger dimensions, but also materially reduced the cost. In course of time many labor-saving devices in auxiliary machinery and for detail work were invented, but the fundamental principle in rolling has not been materially changed. American ingenuity, however, is still actively at work, and in the future highly improved rolling methods undoubtedly will be developed.

The invention of galvanizing, that is, the process of coating iron and steel with spelter, or zinc, for the protection of the material against corrosion, has broadened the field of usefulness of sheet iron and sheet steel enormously.

Previous to the last century, improvements in the methods of its manufacture progressed but slowly. Gradually, and from stage to stage, various modes came into use; principal of which were the Catalan forge, the bloomary or knobbling fire, the blast furnace, and the puddling furnace. It has remained, however, for modern times to make marked advances in the iron industry, and in the production of steel, chiefly by the blast furnace and the Bessemer and Siemens-Martin, or open hearth process. The results have been immense tonnages and the development of a colossal industry.

In the United States the rolling of iron sheets was first started early in the nineteenth century, the first American sheet rolling mill being built in Pittsburgh in 1818, one hundred years ago. It appears that a plant was established by the Pittsburgh Steam & Engine Co. In that year, according to James Swank's book, "Iron in All Ages," the mill was established under the superintendence of Joshua Malen of Valley Forge, a well known figure at that time in the iron and steel industry. The mill had two steam engines each of 120 h.p. An idea of the wonderful development of the sheet iron business can be obtained when it is noted that less than 100 years ago a rolling mill with 240 h.p. was considered a large plant, while now the Vandergrift plant, which is only one of two large groups owned by the company, is equipped with over 12,500 h.p.

On account of the close connection between the steel sheet and galvanizing industries a brief history of the galvanizing process will be of interest. The process of coating iron with tin was invented about 400 years ago in Saxony. The process was kept a secret by the Saxons for nearly 100 years, but after diligent search English manufacturers about the end of the 17th century learned the secret. In England where some time after this discovery the process of rolling sheets was invented, the tin plate industry grew rapidly and for nearly 200 years England maintained the supremacy in this industry. In recent years, however, the United States has become a strong rival and is now the largest tin plate manufacturing country in the world.

Tin plate was first made in the United States in 1872, but owing to the low duty on foreign tin plate, the manufacture of this material ceased in 1878. In 1890 the duty was increased by Congress and manufacturing was started again. Since that date the industry has developed in a remarkable degree in the United States. A few years ago a galvanizing plant was established in Hamilton by the Dominion Sheet Metal Co. and now the sheets are being rolled in Hamilton by the Steel Company of Canada, marking another stage in the industrial development of Canada. The next step will be the manufacture of tin plate and unless all indications prove erroneous, it will not be many years before tin plate is being made in this country.

Steel Company's Enterprise

The success which has attended the Steel Company's operations during the last three or four years has enabled the management to branch out into new fields of endeavor and continue the progressive policy which has always been associated with the concern's affairs. It will be understood that the financial outlay involved in the laying down of a sheet mill is considerable and can only be undertaken by a firm able to command the requisite capital. The Steel Company of Canada has during the past three or four years enjoyed a remarkable period of success and considerably augmented its financial resources. The large demand for its products during this period and business acumen of the management has placed the firm in an enviable position. It has also given the firm an opportunity to develop its business which will not only benefit the company but the country generally by reason of the large variety of home-made products available for other industries, keeping money in the country which otherwise would go abroad and also in the distribution of money in the form of wages. With the growing demand for

GENERAL VIEW OF MILL TRAIN AND COMBINATION SHEET AND PAIR FURNACES. THE COLD ROLLS ARE SHOWN IN FOREGROUND AND HOT ROLLS BEYOND.

TOP LEFT TO RIGHT: CASTING STEEL INGOTS. CHARGING FLOOR OPEN HEARTH FURNACES. REMOVING HOT INGOT FROM SOAKING PIT. BOTTOM LEFT TO RIGHT: INTERIOR VIEW OF BLOOMING MILL. BOTTOM OF BLAST FURNACE. CASTING PIT OPEN HEARTH FURNACE PLANT.

steel sheets in Canada the demand for the company's product will increase proportionately. An advantage which the Steel Company of Canada enjoys is that it makes the steel from which the sheets are rolled and can therefore produce steel of the correct analysis for the purpose for which it is required. The company is thus able to produce a high grade and even quality sheet with perfect assurance.

Other Plant Developments

In order to strengthen the company's position in regard to its supply of raw materials, a most important and necessary factor, the directors have acquired an interest in two valuable ore properties, one on the Mesaba Range and the other on the Gogebic Range. The proportion of the ore which the company is entitled to receive from these two properties will be sufficient to meet over half of its total ore requirements each year for a considerable number of years. The ore taken out each year is paid for on a royalty basis, so that beyond paying for its share of stripping and equipping the mines, no large expenditure of capital was necessary. During its season of 1918 the company will receive its quota of ore from the mine on the Gogebic Range and shipments from the Mesaba Range mine are expected to commence late in the season of 1918. Satisfactory arrangements have also been made recently for an ample supply of coal.

The company is constructing at Hamilton a large by-product coke oven plant which, it is expected, will be in operation by November. An ample supply of good quality coke will always be available for the blast furnaces, thus further relieving the company of anxiety in regard to supplies of raw materials. The by-products obtained from the ovens will make it a profitable undertaking.

Making Steel for Sheets

To impress upon the reader the advantages which the Steel Company of Canada possesses in manufacturing steel sheets, it will be in order to deal briefly with the manufacture of the steel from which the sheets are made. The company makes sheets straight from the pig iron to the finished product. It will thus be realized that the company was in a particularly favorable position to embark on the new enterprise. The plant is complete in every detail, and is generally conceded to be of most modern design and construction. A striking feature is the way in which "Safety First" mechanical appliances have been utilized to gain efficiency, save life and labor and keep down cost of production. Considering the size of the plant it is remarkable how few men are employed, although the pay roll of course is not by any means a small one. The physical condition of the plant is decidedly satisfactory and indicates the far-sighted policy of the management. Electric power is used wherever possible, a factor in the efficient operation of the plant.

Blast Furnace Plant

There are two blast furnaces, having a daily capacity of 400 and 300 tons respectively, one of these furnaces being devoted exclusively to the production of iron for the steel furnaces, while the other produces alternately malleable and foundry pig iron according to requirements of the market. The ore which comes in by boat is brown hematite, one of the richest forms, containing in some cases 68 per cent. of iron.

The blast furnace is charged at the top with ore, limestone and coke, which gradually descend and ultimately melt in the intense heat of about 3,000 degrees Fahr. The proportions of materials forming the charge are carefully regulated and vary according to the quality of steel required. The air for the blast is supplied at a pressure of from 15 to 30 lbs. per square inch, according to furnace conditions, the blowing engines being of the disconnected compound, long cross head, vertical type. The steam cylinders are 44 in. and 84 in. diameter by 60 in. stroke and are placed above the blowing cylinders.

Before entering the furnaces the air is heated to a temperature of from 900 to 1,250 degrees Fahr. by passing through the hot blast stoves. There are three stoves to each furnace, the stoves being 100 feet high by 20 feet in diameter, and heated by waste gases from the furnaces.

Refrigeration is used for drying the air blast before being heated in the stoves. Undried air if blown directly into the furnaces, would carry with it water vapor equivalent to from 1 1/3 to 8 gallons per minute, according to the humidity of the air, materially cooling the smelting zone of the furnace. The process of drying air by refrigeration was originated by James Gayley, a prominent American steel maker. The air-drying plant consists of three 150-ton compound steam-driven ammonia compressors, which supply the necessary refrigeration for cooling brine which is circulated by three steam-driven, fly-wheel type, brine pumps. The furnace is tapped about every six hours, the slag being drawn off through the cinder notch four or five times during this period. When the tap hole is opened, the hot molten metal flows in a channel to the end of the cast house into large ladles mounted on trucks, by which it is quickly transferred to the open hearth furnaces to be converted into steel.

MACHINERY ROLLS. ROLLS ARE LOWERED THROUGH THE TRAP IN ROOF OF MACHINE SHOP BY TRAVELLING CRANE DIRECTLY TO THE LATHE.

Open Hearth Steel Process

Black sheets are made of basic open hearth steel. The open hearth furnaces are always in operation except when repairs have to be made. The charging floor is at the back, and is on the same level as the furnace hearth, while the metal is drawn off on the opposite side. Two charging machines which travel along the entire length of the floor are used for feeding the furnaces with scrap steel and limestone. At the opposite side of the furnaces is the casting pit on the ground level, over which travels an electric crane for lifting the ladles and teeming the molten iron into the open hearth furnaces. This molten metal has been brought direct from the blast furnaces, thereby avoiding the necessity of charging the O. H. furnace with pig iron.

When the steel in the open hearth furnaces has been heated for a certain length of time, during which period other materials have been added to produce a steel of suitable physical properties for sheets, it is teemed into a ladle suspended from the overhead crane and poured into moulds of heavy cast iron construction, forming ingots. The filled ingot moulds are then hauled in a train of cars to the rolling mill, by which time the metal is sufficiently solidified to allow the mould to be drawn off or stripped. This is done by a 75-ton crane, which has a pair of links which grip the mould under the lugs and lift it up clear of the ingot. Another crane immediately grips the ingot and deposits it into a soaking pit, where it is maintained in an upright position at a steady temperature for about one hour.

The ingot is then lifted out of the soaking pit and deposited on an electrically operated truck and carried forward to the approach table of the blooming mill. The soaking pit furnaces are fired with producer gas and the soaking treatment is necessary to allow the ingot to attain an even temperature throughout and also to confine the pipe or segregation core to the centre. The ingot is 15 in. x 17 in. x 7 feet long.

Rolling Blooms for Sheet Bars

The blooming mill is very complete in design and construction and together with its power plant is one of the best on this continent. The installation consists of a two-high 34-inch reversing, motor-driven, Morgan blooming mill. The approach table is operated by a 30-horse power d. c. motor, while the tables on either side of the mill are driven by 100 h.p. motors. The side guards for handling the bloom from one part of the rolls to the other are operated by hydraulic gear. The entire operation of the mill is controlled from a platform or pulpit located above the table affording a clear view of the rolls and the work. The blooming mill is driven by a 3,000 h.p. twin armature reversing motor of special design for this particularly severe service. The ingot is passed back and forth between massive steel rollers, which, while reducing the cross-sectional area, increases its length until, when reduced to 6 inches square, the bloom as it is now termed is about 50 feet in length. After being reduced to the desired size, which is accomplished in 15 passes, the bloom is cut into suitable lengths in a 10 x 10 inch vertical bloom shear. The blooms then pass to the bar mill to be rolled into sheet bars.

The method of rolling sheet bars is very similar to that of rolling blooms as described above. The bloom, after passing through the sheet bar mill is increased in length to 30 feet and is 8 inches wide. The sheet bars are laid on a cooling table and afterwards carried over to the sheet mill.

VIEW FROM ONE END OF THE MILL SHOWING ANNEALING FURNACES, ANNEALING BOXES ON THE RIGHT AND COOLING FLOOR ON THE LEFT. MILL TRAIN DRIVE IN BACKGROUND.

The Product

Steel sheets vary in thickness from No. 30 to No. 12 gauge, in length from 5 feet to 12 feet, and in width from 24 inches to 40 inches. As a general rule sheets below No. 28 gauge in thickness are rolled on a tin mill and sheets over No. 16 gauge should be rolled on a jobbing plate mill. The Steel Company of Canada is rolling sheets from No. 14 to No. 30 gauge inclusive, being the extreme range for the mill consistent with efficiency and economy.

They are "one pass cold rolled and box annealed sheets" and are being used for a variety of purposes. A considerable tonnage is being used by the galvanizers as well as in the automobile trade. The output at present is about 1,500 tons per month but could be doubled if the required amount of steel was available. War conditions prevent capacity production being attained.

The company has not as yet undertaken the manufacture of tin plate although the process follows closely for a certain number of operations that of sheets, with the main exception that sheets are always rolled from heavier bars. In both cases the order of operations is in the same sequence, viz., shearing of the bars, heating of the bars and roughing the bars, at this stage called pairs. The doubling shear of the tin mill, however, is not used in a sheet mill and from this point the operations change. Sheets for galvanizing are cold rolled, close annealed and must pass physical tests required by the most rigid specifications. In fact all sheets are made to stand certain physical tests according to the purpose for which they are required.

Sequence of Operations

The sequence of operations in manufacturing sheets is briefly as follows: Shearing the sheet bars, heating the bars, roughing the bars, reheating the sheets, doubling the sheets, reheating the pack of sheets, finish hot rolling. The next operation is to shear the pack to the required size after which the pack is opened and the sheets separated. The sheets are then cold rolled, annealed, cooled, piled in the warehouse and prepared for shipping. In some cases the sheets are annealed before being cold rolled.

Layout of Plant

The plant is laid out in such a manner that the bars and then the sheets pass from one operation to another, beginning at one end of the mill and finishing at the opposite end. The only exception to this is when the cold rolling follows the annealing. The shears come first, then the furnaces, rolls, trimming shears, while further along are the annealing furnaces, cooling floors and lastly the warehouse and the shippin room.

The mill building is 700 feet long. The main bay is 60 feet wide, and the side bays 29 feet and 20 feet wide respectively. The building is of brick and steel construction with steel roof trusses and monitor roof. The building is lofty, the distance to the overhead crane tracks being 20 feet. A 20-ton Shaw electric traveling crane runs from end to end of the building. At one corner is located a machine shop in which is installed a lathe for turning rolls, and a grinding machine for sharpening the knives for the squaring shear. The pair furnaces are of the combination type for sheet mill work, while the mill train is situated near the furnaces, the motor for driving the mill train being in a separate room built in the main building.

The annealing furnaces at the other end of the building are located in one of the side bays and on the opposite bay is the warehouse. The warehouse is a brick building, steam heated, adjoining the mill building and is 25 feet wide by 100 feet long. The mill offices, lavatories, and shower baths are a continuation of the warehouse. In addition to the 120-inch squaring shear there is another 72-inch shear for smaller and miscellaneous sizes of sheets. Near the

SHEET ANNEALING FURNACES. SHEET BARS AND REAR VIEW OF FURNACES. COMBINATION SHEET AND PAIR FURNACES. WAREHOUSE SHOWING SHEETS BUNDLED FOR SHIPPING.

warehouse there is a small shear for cutting out test pieces, etc.

Shearing Sheet Bars

The bars from which the sheets are made come from the mill in 30-foot lengths, 8 inches wide. The thickness of each bar varies in accordance with the gauge of sheet into which it will be rolled. The sheet bars are piled in their respective thicknesses near the shears. The bars are lifted on to a table on the approach side of the shear and pushed through the gap of the shear until it touches the stop guide on the delivery side, this guide having been previously adjusted to the desired length of crop.

When an order goes through for rolling a certain size of sheet, the proper size sheet bars are sheared and the short pieces piled. The length of these short bars is predetermined by the size of sheet. Each bar is marked with the weight per foot and a number corresponding to the gauge. The sheared bars are now called pairs and are ready for the furnaces.

Combination Sheet and Pair Furnaces

The furnaces are known as combination sheet and pair furnaces, a type now used in modern sheet mill practice. The system consists of two furnaces one behind the other. with a single combustion chamber. The rear furnace is for the bars and the front nearest the mill is for the sheets. Between the combustion chamber and the pair furnace hearth is a bridge wall, and between the pair furnace hearth and the sheet furnace hearth is a second bridge wall. The products of combustion pass from the combustion chamber over the bridge wall to the hearth of the pair furnace, and, after heating the bars, pass over the second bridge wall and serve to heat the sheets in the sheet furnace. The combination furnaces are coal fired and maintained at a temperature ranging from 1,200 to 1,300 degrees Fahr. The bars are fed to the furnace by hand and the sheets or pairs are handled in the same manner.

Arrangement of Rolls

The mill train is two high and has six stands of rolls, four stands being for hot rolling and two stands for cold rolling. Of the hot rolls three stands only are at present in operation, one in the centre for roughing and one on each side for finishing. The breaking down or roughing rolls are 44 inch and the finishing rolls 36 inch. The two stands of cold rolls are 40 inch and 42 inch respectively. The mill train is driven by means of a 650 h.p. Westinghouse a. c. motor through rope drive, the fly-wheel being of large diameter and heavy. The rope drive is at the end of the mill train and provision has been made for installing another mill when necessary.

Rolling Sheets or Pairs

The bars having been sheared into suitable lengths are heated in the back end of the combination pair furnace. After they are heated to the required temperature they are taken out of the furnace by means of tongs, two at a time, the heater throwing them to the roller. The roller takes first one bar and then the other, passing them through the roughing or breaking down rolls two or three times to the catcher on the opposite side of the stand, who returns them over the top roll, using its direction of rotation to assist in this operation. After two or three passes in the finishing mill the roller places one of the bars on the top of the other and they are given as many passes as the heat will allow.

As the sheets cannot be rolled thin enough in two thicknesses except in the heavier gauges, they must now be doubled. This is accomplished by taking one end of the sheet and doubling it over another and taking it to the doubling machine. The doubling machine consists of a vertical plunger press which closes down the sheets, one on the other. When rolling the lighter gauges of sheets, the bars are put together in threes, fours or fives. After doubling, the result is a pack of four sheets but practically cold. The pack is now put into the front or sheet furnace and reheated. After being heated to the correct temperature the pack is again carried to the roller and repassed through the finishing rolls several times until the desired thinness is obtained. The roller knows when to stop rolling by gauging the length and width of the sheet. The pack does not weld together because the top friction roll runs slower than the positively-driven bottom roll. As in the case of the shearer, the roller receives instructions as to the size of sheets to be rolled on a certain rolling so that the various gauges will not get mixed up. The mill is in continuous operation, the crew of eleven men working right through for the eight hours' shift.

The pack of sheets, four or more in thickness, is now carried over to the squaring shear to be sheared to the size called for in the order. The squaring shear has a 120-inch knife. The pack is now opened that is separated into individual sheets. If the rolling has been done at a proper heat this is a matter of little difficulty, but occasionally they stick together and have to be separated by means of a blunt knife. After the pack has been opened the sheets are inspected. The sheets are then piled according to their respective gauges.

Cold Rolling Process

The usual practice at this mill is to give the sheets one pass in the cold rolls before annealing. Sometimes this operation is reversed. The process of cold rolling consists of passing the sheet through a pair of rolls exactly similar to the hot rolls, but without reheating the sheet. The cold rolling flattens out the sheet and removes burrs or fins on its edges caused by the shear knives. When the sheets are annealed before cold rolling, the rolling accomplishes the above and in addition closes the pores of the sheet, resulting from the annealing treatment. It also gives the sheet a clearer and brighter finish which is desirable for some classes of work. Sheets required for galvanizing are cold rolled before being annealed. Before being galvanized the sheets are pickled, a process which cleans the sheet and removes the scale, etc., thus a bright finish at the mill is unnecessary.

Annealing the Sheets

After the sheets have been rolled they are hard and must be annealed before they can be usd commercially. The sheets are taken from the piles near the mill, placed in bundles on a cradle and carried by the overhead travelling crane to the annealing furnaces at the other end of the mill building. Annealing is an important operation as the sheet must be sufficiently soft to stand working up.

At the present time there are three double annealing furnaces, but provision has been made for as many more. The furnaces are of brick and are coal fired, being closed at one end and having two doors at the other. The process used ot this mill is known as box- annealing, the sheets being contained in pots while in the furnace. The annealing pots are made of cast iron and will hold about 12 tons each. The sheets are laid on the bottom of the pot, called the pan, and piled up neatly, flat. The cover is then placed over the pile of sheets and secured to the pan, the bottom being sealed with sand to keep the air out. It is important to have as little air as possible in the pot. The pot is now lifted by the overhead crane, laid on cast iron balls and pushed into the furnace. The floor of the furnace has tracks upon which the balls run.

When the furnace is charged, the heat is applied until the whole mass, both pots and sheets, is red hot. The fire is then reduced, but the sheets are allowed to remain in the furnace a few hours longer to partially cool, at the end of which time the fire is banked. The time occupied in this operation is about 24 hours firing and 15 hours partially cooling or soaking. The charge is now withdrawn and the annealed sheets are allowed to stand for about 24 hours in the pots, after which the covers are removed and the sheets allowed to stand until cold enough to handle. The sheets are then removed from the pan and laid on the floor to finish cooling. If they are to be shipped as black close annealed they are ready for final inspection and the warehouse. If they require cold rolling they are carried back to the cold rolls at the other end of the building. The extreme heat in the annealing furnaces ranges from 1,300 to 1,500 degrees Fahr., this temperature being maintained for about three hours.

The final operations which consist of marking and bundling are performed in the warehouse which it will be remembered comprises one bay of the main building. When the sheets are taken from the cooling floor they are weighed on factory scales in the warehouse and laid in piles according to size and gauge. To facilitate handling the sheets are made up in bundles, each bundle weighing about 150 pounds. Each bundle is marked, giving the size, gauge and weight per foot, the company's trade

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The Gas Industry and Canada's Fuel Problem

Dealing With the Great Strides That Have Been Made in the Manufacture and Use of Gas For Both Home and Industrial Purposes—Its Uses Defined and Why it is More Economical to Many Industries When Every Phase of the Business is Taken Into Consideration

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THE condition which prevails in Canada to-day, with regard to the supply of fuel necessary for the maintenance of the industrial activity of the country, and for the domestic requirements of its population, demands a careful survey on the part of Governmental authorities, and that every possible economy be exercised in order that the total requirements of fuel may be reduced to a minimum.

The fuels available for use in Canada may be generally stated as coal, wood, petroleum, gas, and water power electrically distributed. Each of these fuels has certain inherent advantages and their economic value is largely determined by the service to which they may be applied, and the localities in which they may be required.

In considering the economic value of various fuels on which Canada may rely to meet its domestic and industrial requirements, manufactured gas, or what is sometimes called "City" gas, must be given an important place. Originally used only as an illuminant, gas has become one of the vital necessities of the domestic and industrial life of urban communities throughout the civilized world.

In using the term "City" gas, I mean gas as ordinarily manufactured by gas companies, and distributed through pipe line systems laid beneath highways of cities and towns. In the early days of the industry, this commodity was called "Coal" gas, for the reason that it was produced entirely from bituminous coal. The qualifying word "City" may be appropriately prefixed to the commodity as now supplied in recognition of the fact that economic considerations have caused different localities to combine with the coal gas what is known as carburetted water gas. Indeed, in many cities on this continent carburetted water gas now forms the whole of the supply.

For practical purposes, however, there has been very little difference in the general character and useful properties of city gas, during more than one hundred years.

The tremendous development and growth of the gas industry, particularly during the past ten years, furnishes abundant evidence of appreciation by the public of the merits of the commodity supplied, and of the economy in the use of gas for the thousand and one purposes for which it is now so well adapted.

Its success in holding the market against all rivals of the same order of utility is due, largely, to its possession of certain valuable and unique physical properties, viz:

(1) It is a permanent gas, suitable for consumption in or out of doors, either as an illuminant or as a smokeless fuel of high or low intensity, or as a source of motive power; all from the same supply system.

(2) It is susceptible of perfect subdivision without loss of efficiency for use in either required application for lighting or the production of heat or power. The cost to the consumer is always in direct proportion to the quantity consumed.

(3) It is a readily available fuel, cleanly and inoffensive, to be obtained by the turning of a tap, which will grill a chop, boil a kettle, or heat a flat iron, and there is no metallurgical or smith's work for which its heat is not adequate, no household warming for which it is not suitable.

City gas as supplied in Toronto is made by the distillation of Youghiogheny and Westmoreland coal, obtained in the Pittsburg district, with the addition of about 40 per cent. of carburetted water gas.

At this point it might be interesting to see what a gas company can secure from a ton of bituminous coal.

In the first place, a ton of gas coal in an efficient carbonizing plant will yield ten thousand cubic feet of gas, from which may be extracted a certain percentage of benzene and toluol. It will produce approximately 1,350 lbs. of coke, from which, after providing the necessary fuel for the producers, there will be left a residue of from 800—850 lbs. of coke to be marketed as fuel for steam raising, industrial purposes and for domestic use. It will yield ten Imperial gallons of tar, from which may be recovered toluol, benzene, fuel oil, acids, dyes, etc. Another important by-product is ammonia, useful in the manufacture of fertilizer, and for refrigeration and other purposes. There is also, as a minor by-product, retort carbon, which is used in the manufacture of carbon electrodes for searchlights, electrical steel furnaces, etc.

It is estimated that the percentage of efficiency obtained from coal in a gas works will run from 60 to 70 per cent. Compare this with the efficiency obtained in general practice from a ton of the same kind of coal used in an open fire which has just been fed with coal. Would the efficiency be 20 per cent. or less?

Let us make another comparison, and remember that the object of our discussion is to find the most economical way to use fuel, and especially coal.

The available supply of anthracite coal is admittedly limited, and the need for conservation is probably greater with regard to it than is the case with any other kind of fuel. From every thousand tons of bituminous coal which a gas company carbonizes it produces and makes available for general consumption, as a substitute for anthracite coal, four hundred tons of gas house coke. The value of coke, as compared with anthracite coal, may be observed from the following analysis:

	Anthracite Coal	Coke
Moisture (after air drying)	3.20	1.60
Volatile combustion	6.86	8.27
Fixed carbon	76.61	76.23
Ash	13.33	13.90
Sulphur	.92	.94
Gross B.T.U. per lb.	12800	12200

Gas for Lighting

Under the conditions formerly prevailing when gas was sold exclusively for lighting by its luminous flame, the criterion of its value to the consumer was its illuminating power, but since the introduction of the Welsbach system of gas lighting by the heating to incandescence of a foreign substance in the Bunsen or non-luminous flame of gas mixed with air, gas is merely burned as a fuel just as for the purpose of cooking, and generation of motive power.

Gas for Cooking Purposes

Aside altogether from the cleanliness, ease of control, reliability of quantity and quality of supply, in which respects it stands pre-eminent, in point of economy there is no fuel which at prevailing prices can begin to compare with the cost of gas for certain kinds of service. If gas exclusively were used for cooking in the City of Toronto there would be a large money saving to the consumers, but more important than this saving would be the economic advantage gained by having to import so many tons less of anthracite coal.

Gas as Fuel for Industrial Purposes

A great deal has been said from time to time as to the insanitary conditions of the atmosphere in our city, caused by the discharge of black smoke from chimneys. In spite of by-laws, and the watchfulness of officials concerned with their enforcement, the evil seems to remain unabated, with every prospect of conditions becoming worse with the further growth of the city.

The problem of furnishing power, without making smoke, is rapidly being solved by the use of water power, dis-

*Read before the Canadian Society of Civil Engineers, at Toronto.

tributed by electric lines. The use of coal in manufacturing processes, however, is still to be considered. Here the gas industry offers a means for the displacement of crude heating, which not only disestablishes the chimney as a polluter of the atmosphere, but introduces into the factory itself a controllable and uniform system of heating, producing constancy of result, and adding materially to industrial economy by the reduction of labor, the promotion of cleanliness and the speeding up and improvement of factory output. These aspects of the case require the main part of our consideration, but without going into details we might well consider also the great destruction of value for which the present crude methods of heating in factories are responsible. While gas can supply heat so easily controllable that there is comparatively little waste in obtaining from it effective duty, with coal there is necessarily a large waste of heat. There is a large amount of heat wasted in effecting its combustion, and in driving off those volotile constituents which are useless where high temperature and pure incandescence are required. There is also waste of heat up the chimney and through stand-by requirements. There is waste of heat every time a fire is re-charged until once more favorable working conditions of the fire are obtained. With the gas as fuel, the heat can be directed exactly as needed into the furnace, and heat losses by radiation and otherwise can be reduced to a minimum.

I do not say that coal can be entirely displaced in factories; but I claim that a large part of it could be. The point I wish to make is, that, in addition to air pollution, our industries are largely wasting, by their crude methods of heating, parts of the substance of the country which are necessary, more necessary to-day than they ever have been.

If these statements are correct, it can readily be seen how vast an opportunity there is to benefit the country at large, if we are able in any appreciable extent to do away with this waste. In case of any doubt as to the practicability of accomplishing this result, I believe that when it is seen how much has already been done, in developing gas appliances to supplant the crude methods still so largely used, our knowledge of possibilities will lead us to believe that we see only the dawn of a new era in industrial heating.

The manufacturer has his point of view in this matter. It is not sufficient to explain to him how the use of gas will benefit the community, it is necessary to show him that it is to his direct benefit as a manufacturer to adopt the modern methods of using heat in his processes. Some of these advantages are:

1. Economy in space occupied by appliance, and in some cases the necessity and expense of a smoke stack is avoided; a practically unlimited choice of a position for the furnace, which enables it to be brought into close proximity to the machine workers.

2. No space required for storage of fuel, and no removal of ashes.

3. Increase in output per cubic foot of factory space, owing to economy of space occupied by gas furnaces in comparison with coal furnaces.

4. The constant and unvarying supply of fuel, of a uniform heat value, at a fixed rate.

5. Labor saving—absence of stoking, storage and conveyance of fuel.

6. Rapidity, and improved production, due to ability to precisely control working temperatures.

7. In many cases a lower capital expenditure for installation.

8. Cleanliness, which frequently assists in decreasing net labor cost.

9. No interest to be paid on investment in fuel in storage.

10. Reduced fire risk.

11. No loss of material due to inability to check a high temperature instantaneously.

12. Less repairs on equipment.

13. Enormously smaller loss from articles or materials being spoiled by irregular heat.

When these points are taken into consideration, it is really astonishing how many instances there are where the total cost of manufacturing is less with gas than with coal.

The following list contains but a few of the hundreds of successful gas appliances available, and in use, and while the consideration we can give to each will be necessarily brief, it will give a fair idea of the accomplishments in this field.

Baking Ovens.—The use of gas for baking bread and pastry in small bakeries, restaurants and institutions has proven very satisfactory. With large bakeries, however, although some progress has been made, there is yet much more business to be secured for gas.

Japanning Ovens are of two general types—the direct heated, and the indirect heated. In the direct heated, the fuel is allowed to burn in the japanning compartment; in the indirect heated, the fuel is burned independently of the japanning compartment, the products of combustion being carried up through radiators placed at the sides of the oven, and then carried out through suitable flues. Gas is superior to steam for heating japanning ovens, where temperatures from 150° F. upward are required. Gas is superior to coal on account of its cleanliness, time consumed in getting oven ready for baking, dust and dirt incidental to the use of coal, and for many other reasons. With the use of gas, temperatures can be exactly regulated according to requirements, while a coal fire is not capable of being so regulated.

Heating Liquids

Glue Heaters—The heating of glue is one of few processes where the difficulty is not that of getting enough heat, but of getting too much. Glue should not be heated over 150° F. If it is heated to the boiling point of water it is practically ruined. It is hardly necessary to say that the ease with which an exact temperature is maintained by the use of gas puts this fuel in the first place as a means of heating glue. The appliances are quite simple—just one or more pots of suitable size, suspended in water, the water being kept hot by means of a small burner. There is also a contrivance supplied with a mechanical agitator, which is useful in assisting to dissolve the glue.

Cauldron Furnaces.—These are constructed either round or rectangular in shape, and are generally direct-fired, in which case the gas burner is placed immediately below the cooking cauldron. Sometimes, where the materials to be heated will burn easily, a water compartment is interposed the same as with glue heaters.

Cauldron furnaces are made in sizes ranging from five gallons up to 150 gallons, and sometimes even larger. They are extensively used, and with almost universal satisfaction. Some of the uses to which they have been adapted are as follows:

Rendering lard, scalding chickens, heating potash, making disinfectants, making face creams, cooking meats, making marmalade, jellies, etc., canning fruits and preserves, boiling syrups, metal polishes, wax melting, grading oils, making pastes, making soap, heating water, dyeing, cooking potato chips, making soups, making soft drinks, etc., making catsup, pickling vegetables.

Bakers' Fryer—This is practically the same as a cauldron furnace, except that some manufacturers supply simply a burner and frame without the cauldron, thus allowing the customer to use the same utensil which was formerly used on the coal-heated stove. It is used for frying crullers, potato chips, etc.

Confectioners' Furnace.—The success of the process of boiling candy is mostly one of securing the right temperature. A certain amount of moisture must be driven off from the original mixture of sugar, water and other ingredients before the proper temperature can be reached. The gas consumption varies from 1½ to 3 cubic feet per pound of candy, according to the temperature required.

The gas confectioners' furnace has many advantages over furnaces using coal or coke. Cleanliness is one of the most important items in a place where candy is being made. Of course there is absolutely no dirt from the fire when gas is used. The furnace is always ready for immediate use. It makes the keeping of the factory cool, in summer, much easier. If a proper gas furnace is used, a great deal more work can be turned out than with the best coal furnace. The heat can be regulated at the will of the operator, which cannot be done so readily with coal.

DEMAND FOR BALING IRON IN NEW SOUTH WALES

Users of baling iron such as is required for use in dumping wool bales report a great scarcity of this commodity. The size used is 15-16 of an inch and the gauge 20.8. It is shipped in coils of approximately 56 pounds, and a recent quotation from the United States was £74 per ton, c.i.f. Sydney. Delivery subject to space being available .

Russia's Need of Imports and the Resources Available for Payments

Lack of Stable Currency Not an Unsurmountable Barrier — Present Fluctuating Values Militate Against Cash Payments—Exportable Products Still Plentiful

By Sterling H. Bunnell in *Russia*
Chief Engineer, R. Martens & Co., Inc.

EVERYONE interested in the triumph of the forces of democracy in the war agrees that Germany must not be permitted to obtain either permanent military control or any degree of commercial domination over Russia. Lacking necessary factories and industries adequate to supply the country's needs, Russia can be rescued only by Allied aid from becoming the broad base of a towering pyramid of Germanism from which the Hun can launch his next attack on civilization. In some form or other, assistance must be given by Allied countries so as to free Russia from economic dependence on Germany. Large exports must soon be started for Russian ports, to supply the most pressing civilian needs.

A Misconception

Any idea among American business men that Russia is commercially finished, and that her international trade is dead, is founded on misconception. Russian paper currency is in truth almost worthless in foreign trade, though used freely in domestic interchange. But exported goods are not usually paid for in foreign currency.

If a country should continue to buy goods from abroad for money, it would in time pay out all its gold and silver money and lose credit for its paper notes. Continuing export trade must be balanced by import trade of equal value. Part of the value, either outgoing or incoming, may be paid in labor of citizens for foreign countries, or in services rendered tourists from abroad, or even in gold money, if the citizens can keep up the supply by mining gold.

The lack of a stable currency in Russia makes it difficult for an American manufacturer to come to terms with a buyer in Russia, but does not make international trade impossible.

Trade Factors

The Russian citizen with earnings or income in rubles wants to use his funds in buying clothing, boots, or other necessary articles which must come from abroad. The only obtainable articles, however, are Russian raw products, hemp, flax, skins, and the like. The American manufacturer of the clothing or boots wanted in Russia must receive dollars in return for the purchase of materials and payment of labor. Other American manufacturers want the hemp, flax, etc., which Russia has for sale, but may not pay for them in gold while Russian exchange is fluctuating so that the real dollar value of a shipment is very uncertain.

There are thus four different parties, all wanting to engage in international trade, but no one of them in position to complete the transaction by himself. In normal times each one could make his trade by the aid of the foreign money exchange brokers—under actual conditions, only international banking and exporting firms are in position to balance trade against trade and so restore trade with Russia.

In spite of the utter disorganization of Russian production during three years of active warfare, the country is by no means destitute of exportable products, nor have the invading Germans access to all of the supplies. A considerable portion of Russian exports comes from Siberia, and has been accumulating, at a decreasing rate, for three years. It is not probable that German penetration and influence will extend even as far as the Ural Mountains. Siberian goods are likely to remain available for export to the eastward if Allied manufactures can be had in exchange; otherwise they will eventually reach Germany. American importers and manufacturers in need of raw materials from Russia should put themselves in communication with reputable firms having export connections for the double purpose of supplying their own wants, and of counteracting the German commercial threat.

A New Period

The direct exchange of exports for imports will begin the new period of trade with Russia. The movement toward restoring the trade balance will be assisted by the coming industrial development of Russia by foreign capital. In the chaotic period since the Revolution, more than one large Russian industrial plant has passed from Russian to foreign ownership; each such transaction requires a payment to Russia from foreign countries, and so offsets a portion of Russia's foreign indebtedness.

Russia to-day may not appear to the uninformed as an attractive field for investment, but those who know Russian possibilities and conditions are already buying up established industries and investigating prospects for creating others. Mines of coal, iron, and valuable metals; oil wells producing red or white naphtha fit for use without refining; railway concessions opening up untouched territory, and enormous possibilities of agricultural development by machinery on a large scale, are already passing to foreign ownership.

Early Action

In these ways trade will find for itself a method of helping Russia out of present destitution. Undoubtedly, the requirements of the Russians are so great that the sale of already existing products and property will not by itself provide funds sufficient to make Russia again an independent, self-supporting nation. The important thing is to begin the process as soon as possible and carry it as far as the means allow. In due time sound counsels and stable government in Russia will facilitate reconstruction by liberal laws, and will arrange for international loans by Allied countries so that refitting Russian industry can proceed freely.

In theory, perhaps, the Russians are down and out and cannot buy anything. The condition of the people, however, is such that they must have goods, and therefore they will find ways and means of buying them.

A SUBSTITUTE FOR CORRUGATED IRON

Efforts to practice economy in the use of steel and iron have developed and are now resulting in a satisfactory substitute for corrugated iron and sheets. It is an asbestos-cement roofing material. During the last year a large plant has been built in England for manufacturing this product. The method of making it is as follows:—After being finely ground and freed from extraneous matter the asbestos, which acts as the reinforcing agent, is mixed with Portland cement in the proportion of about 1 to 6. and made into a paste with water. This paste is then taken to a machine of the paper-making type, where on a large revolving drum it is formed into sheets or felts. After the sheets have been trimmed to size, they have the corrugations impressed on them. The important condition for this operation is to insure that the tops of the corrugations are as strong as the other parts of the sheets. Finally the sheets are subjected to a "seasoning" process. The corrugations are made to the 3-inch pitch which is usual with corrugated iron sheeting. not to the 2½-inch foreign pitch, and they can, therefore, readily be used to repair roofs of corrugated iron. The sheets are also fireproof and are poor conductors of heat. Corrugated asbestos-cement roofing of this character has been made in Canada for a number of years at Lachine, Que.

The Design of General Purpose Agricultural Tractors*--II.

By Alan E. L. Chorlton, C.B.E.

Mechanical appliances are of great importance in the quantity production of foodstuffs so needed to-day. The following article deals with the problem of co-ordinating the widely separated pursuits of engineering and agriculture in the design of farm tractors and affords an interesting view of the problem as approached from the standpoint of English practice.

The Engine

ANY consideration of the engine must begin with the conditions under which it has to run on a farm, the inexpert attention likely to be given to it being an important factor. Generally, whilst this necessitates robust construction, it also calls for a low power rating or a considerable reserve of power, and probably the factors of low speed, large cylinder capacity for power required, strength and simplicity of parts are the main ones. That the engine must operate on kerosene is a sine qua non, and, further, it is preferable that it should develop its power without water injection.

The gain to be obtained by the use of crude oil in a high compression engine would justify the greater refinement of the engine, though there is greater difficulty in obtaining the fuel, kerosene being probably the most universally and readily obtainable of all oil fuels. On the other hand, such an engine running on kerosene would probably use up to 30 per cent. less, a very material and important saving, and one which should induce the engineer to persevere with this type; the fact that the automatic ignition of this type removes the risks of all electrical gear must be borne in mind. It should be quite possible, however, to secure better economies with the ordinary engine than are at present customary. It may be taken that the consumption per acre in practice is 3 gallons, often more, sometimes less. A 20-h.p. tractor has probably an average load of not more than five-eighths of the maximum, or, say, 12½ brake horse-power (see dynamometer readings—three shares, plus allowance for stoppages and headlands). Taking 2 hours per acre, this gives, say, 12 pints per hour, or 0.96 pint per brake horse-power. This result is not at all a bad one, and is probably much better than what is actually taking place in day to day work when the tractor is run by an ordinary farm hand. It should be possible to cut it down to 0.85 pint per brake horse-power, or with a high-compression engine to 0.6 pint or even less.

The type of engine used, whether vertical or horizontal, would in practice largely depend upon the plant of the manufacturer, four-cylinder vertical engines being naturally adopted by the motor-car engineer, whose factory is suited to that type; where factory considerations do not step in it might very reasonably be claimed that the horizontal type is to be preferred. It has frequently been found in practice with vertical engines not possessing vaporizing devices in the engine cylinder that some of the kerosene fuel passes the pistons and mixes with the lubricating oil in the crank chamber, with a consequent thinning of the lubricant, which causes excessive wear on the main and crank-pin bearings. It is not suggested that there are not many effective kerosene carburettors on the market, but rather that, despite these, with the class of labor available on the farm for operating the tractor, such action will frequently take place in starting up and on light load.

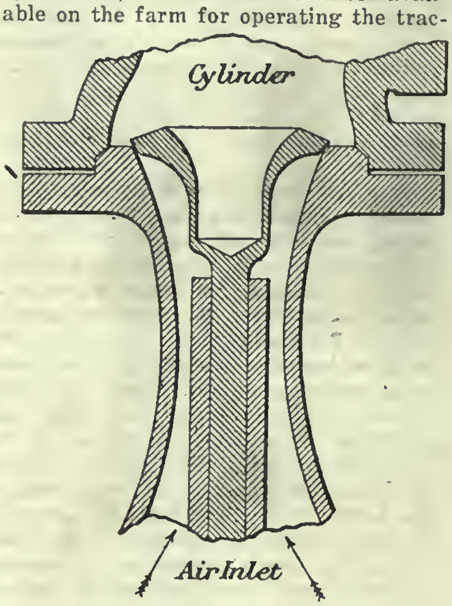


FIG. 10—KEROSENE VAPORIZER

The horizontal engine gets over this difficulty, inasmuch as excess kerosene will drain off through the exhaust valve before reaching the piston. A form of inlet valve which has been very successful is shown in Fig. 10. It will be noted that the hollow head, which is kept hot by the cylinder temperature, is arranged so that the entering gases in passing at a high speed through the venturi will impinge upon the hot walls; this forms an effective and compact vaporizer, and at the same time being in an inverted form, is self-draining. It must not be forgotten that the hot bulb engine can work with tube ignition, thus cutting out the electric installation, which is of all parts of the tractor probably the least understood by the farm hand; incidentally the running cost is reduced, as petrol is not required for starting up. Thus such an engine could be arranged to operate by tube with but trivial alteration in case of failure of the electric ignition.

The water injection, so often found in the high-speed engine of the vertical type, cannot be said to be conducive to long life; it was tried years ago in gas-engine practice and eventually dropped.

The vertical quick-running type can be and is manufactured at a less total weight, and this has been an additional reason for its use on light-weight tractors. It is, however, quite reasonable to ask whether, despite our being used to comparatively high-speed engines on motor cars and wagons where the average load is low, and the quality of fuel and the attention good, a speed of 500 r.p.m. can be exceeded under the conditions of farm service, quality of labor, heavy plowing loads and kerosene fuel, without a more than proportionate risk in wear and tear. Fig. 5 shows diagrammatically the two types of tractor, of which there are, of course, many variations.

Further, it is considered desirable that full power should be obtained with a mean pressure of only about 50 lb. per square inch, and that as in the horizontal type of engine the vaporizer should be in the cylinder head and allow of easy drainage for the use of low-grade fuels. A suitable arrangement has already been described in Fig. 10.

It is quite true that the high-speed engine reduces the weight of a tractor, but in view of the necessity of giving a reasonably long life under the conditions of farm usage, it is debatable if this is a wise policy. A comparison with a light-weight tractor on a basis of cylinder capacity indicates that these tractors obtain their light weight per horse-power largely by high engine speed and rating.

Type of Tractor	Wght. lb.	B.H.P.	Bore in.	Stroke in.	Revs. per min.	Np. lb. per sq. in.	Np. wght. tons	Vol. swept per min. cu. ft.	Vol. swept per B.H.P. cu. ft.	Vol. swept, wght. tons
Four-cylinder vertical light tractor type	3,000	25	4¼	5¾	900	67	50	340	13.6	254
Two-cylinder horizontal multi-purpose tractor....	5.600	28	7½	11	475	48	10	534	19.0	214

Flywheel Effect

It is very desirable to arrange for ample storage of power in the flywheel of the engine to provide for the momentary excess required when meeting hard places, whereby the engine is subject to less strain, and the fuel consumption should also benefit. In the horizontal type suggested the flywheel effect is sufficient to provide 50 per cent. power increase for about 30 seconds. In the light tractor with a quick-running engine there is usually considerably less power storage in the flywheel, and the engine must bear directly the extra demands and shocks.

*A paper read before the Institution of Automobile Engineers.

Cooling

Two methods are in vogue for cooling the engine—in the one the motor-car system, a radiator, fan and circulating pump are used, and in general the whole conforms very much to the standard practice in this respect. In the other system tank storage is adopted, the cooling of the motor being obtained through the loss of heat, due to evaporation from the open tank (the released latent heat, of course, effecting this).

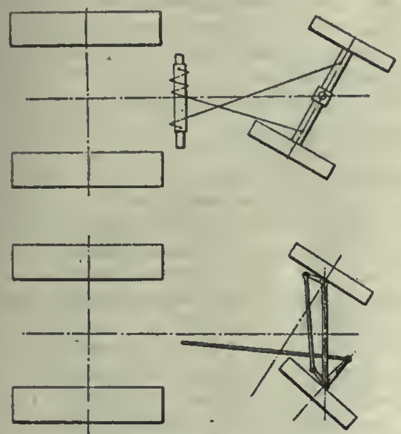


FIG. 11.—STEERING ARRANGEMENTS.

The tank system is simple and is more fool-proof in its working. It allows of almost any sort of water being used, such as is found in streams and drains about the fields, but on the other hand, it needs considerably more make-up water than does the radiator system. The advantage of the radiator system is the much smaller quantity of water needed, so that if water is scarce the saving in cartage may be considerable. Its disadvantage is that the radiator itself may silt up or in some way develop leaks. Both systems are used and probably local conditions will govern the choice.

Frame

The older type medium-weight machines employed as a rule a special frame built up of rolled sections, whilst later designs, in order to save weight, have incorporated the frame in the general design of the machine with advantage. This feature should undoubtedly be adopted in the design of a multi-purpose machine.

Gearing

The typical forms of gearing for the two types of tractors are shown in Fig. 5. In one we have the design based on the motor-car arrangement, using either bevel or worm gears, and with a high reduction on account of the high-speed engines, and in the other the design is based on that of the steam traction engine, in which neither the bevel nor worm is necessary: due to the cross-setting of the engine this type has not usually been totally enclosed. This feature, i.e., the total enclosing of the gearing and the running of the gears in oil baths, which originated in motor-car practice, should undoubtedly be incorporated in the other. As the test detailed in Fig. 7 indicated, the loss in the gearing is high, due probably to the exposed gears, want of alignment under load and insufficient lubrication. When the horizontal engine type is built with all its gearing totally enclosed, the efficiency should be equal to motor-car practice. As the reduction is less, and as no bevel or worm is employed, it is not unreasonable to expect from the horizontal engine a higher overall efficiency than from the high-speed engine design. The advantages of ball or roller bearings in the reduction of frictional losses are questionable. Published tests indicate but small bearing losses, so that any gain would be trivial.

Steering

There are two types of steering, the single and double pivot. The one is practically the standard in present agricultural machines, as steam tractors, etc., and the other is the standard in motor-car practice. The first is simple, cheap and strong in principle, and outside agricultural work it is chiefly used in steam-wagon practice. Yet despite this, there is a general tendency to adopt the double-pivot system for small tractor work, and this system, when centrally mounted so as to give three-point suspension, is to be preferred for the class of tractor under consideration (see Fig. 11).

Wheel Arrangements

Fig. 12 shows some of the arrangements of the wheels of tractors on the market for each of which the makers claim special advantages.

It is not proposed to enter into an examination of the claims of any particular arrangement, as they refer solely to land work and not to the road, their use on which is somewhat in the nature of a by-product. The need for a tractor to be an efficient machine for road work materially narrows the field of selection, and as long practice has proved that, for the power contemplated, the two-track four-wheel machine is the most suitable, this seems undoubtedly the one to be selected, as such a wheel arrangement is equally effective on the land. The size of wheels may be 3 ft. by 5 in. for front wheels, and 4 ft. by 12 in. for back driving wheels.

It is noticeable that there seems to be a tendency in tractors now coming into use to adopt rather smaller diameter wheels (4 ft.), probably with a view to reduce weight. There are two views as to the value of diameter and width, but it is not proposed to enter into these now. The matter was somewhat extensively gone into in a paper read by Colonel Crompton before this institution in April, 1913. and in an appendix to the same prepared by Mr. Leslie Hounsfield.

The caterpillar arrangement. whilst entirely suitable for special conditions on the land, cannot be considered as an advisable type for regular road work, and is, therefore. not discussed for the dual purpose called for.

In order to stand up to the road work the wheels of the tractor must be specially strong, though this naturally tends to increase of weight. It is true that, to save in the total weight of the tractor, light wheels might be adopted for work on the land, so designed as to be readily replaced by specially strong and heavy ones when the tractor is required to run on the road. In actual practice, however, it is probable that the inconvenience and time taken in changing such wheels, together with their considerable extra first cost, would very much limit, if not ultimately eliminate, any advantage there might be in this proposition, though it has been frequently suggested.

All axles for road locomation must be mounted on springs, and this can be readily done in the type of tractor adumbrated. A road engine, beside having all its weight sprung and the wheels of extra strong design, must in itself be so designed as to properly take care of the vibration set up by such duties.

Land Grips

As has been indicated, the projections attached to the rim of the driving wheels to obtain sufficient hold when plowing are an important feature, and their design to obtain efficient working is one of no inconsiderable difficulty; the paths traced by three different forms are shown in Fig. 6. The spuds must be of such size and form as to obtain effective hold on the land, and yet not set up too great an increase in rolling resistance by their shape; they should be self-cleaning, and so formed and fitted that, should the differential come into operation and only one wheel revolve, no such side force is set up as may cause the tractor to slip sideways at right angles to its path.

Generally the older forms of tractors, altrough they gave good service, do not appear to have received sufficient care in their design regarding the points discussed, and they frequently lacked the finished appearance of a complete design due to the apparently haphazard arrangement of the constituent parts, i.e., engine, gears, etc., on a rolled section frame.

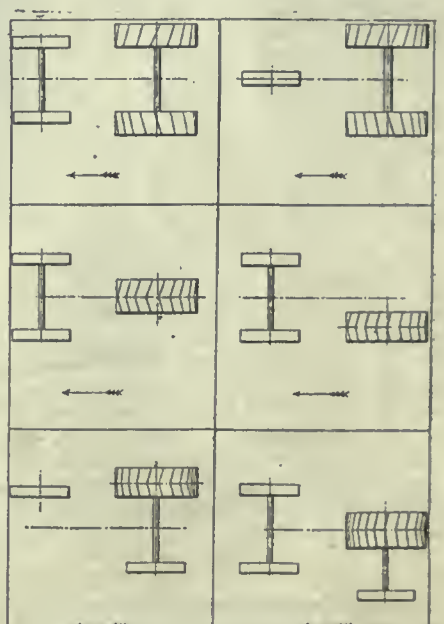


FIG. 12—WHEEL ARRANGEMENTS.

Progress in this direction has undoubtedly taken place, as is shown by the light type of tractor now coming on the market, in which a separate frame is obviated, and it is obvious that the design was completed at one time by an engineer trained with an eye to the appearance of the whole. Similar ideas might be incorporated in the horizontal type of engine, with undoubted advantage.

There are very many other questions and points of interest that might well have been discussed, and which the author would have liked to deal with, but the time at his disposal has been too limited to afford adequate treatment. He hopes, however, that sufficient data have been brought forward to start others upon the investigation of the problem of the agricultural power unit and to form the basis of a discussion to-night.

STEEL CO. OF CANADA

Continued from page 6.

mark is also stencilled on each bundle. The trade mark is the word "Stelco" on a maple leaf. For some orders the sheets are packed in cars and shipped without being bundled. Some orders call for the sheets being oiled before shipment, the oiling being done in the warehouse. The company manufacturers tack plate, which is made by the same process as black sheets but is not annealed.

Quality and Service

The operations involved in the manufacture of black steel sheets have now been followed from the raw materials to the finished product. The lay mind would hardly appreciate the amount of work and skill involved in the production of sheets or the great care that has to be exercised in every detail of their manufacture. Quality counts, and this can only be obtained by careful and systematic adherence to details in the various processes. Efficiency in operation is also a vital necessity if the proposition is to be a success financially. Judging from appearances at the plant the efficiency factor is high and consequently the results are in proportion. The consuming public in Canada will better appreciate the value of having a full supply of sheets available when normal conditions prevail and the company is in a better position to satisfy all requirements. As in other industries, the war is interfering with manufacturing operations to the extent that only a certain tonnage of steel can be allocated to the manufacture of sheets. In the sheet mill provision has been made for duplicating the existing plant, which will be done when the demand calls for larger production.

The Minimum Wage.—The minimum wage of adult experienced female workers in any factory in Winnipeg where foodstuffs other than candies are manufactured shall not be less than ten dollars per week, according to a statement issued by Dr. J. W. MacMillan, chairman of the Manitoba Wage Board. Exceptions are pickle, vermicelli and macaroni factories, where the minimum wage shall be $9.50 per week. Hours of labor shall not be more than nine hours a day.

Canadian Manufacturers' Association Meet in Montreal

THE annual convention of the Canadian Manufacturers' Association was held in Montreal on June 12 and 13. The principal features of the opening day were the president's address and a report of the tariff committee dealing with the United States embargo.

The President's Address

Defending the manufacturers against the charges of bolstering up tariff walls for personal aggrandisement S. R. Parsons, in his presidential address, declared:

"The profits of manufacturers, generally speaking, have been grossly exaggerated, and while here and there abnormal figures are shown (which are subsequently largely extracted by the Business Profits Tax), yet the large profits feature also applies in the case of agriculturists. The great majority, however of, these two classes, as well as of all other classes in the country, are simply making reasonable and necessary headway.

"The time has arrived when the government, members of Parliament and the people at large must be fair to the manufacturers of this country and not consider their interests as a football, to be kicked about by interested politicians and others, otherwise the national interests are sure to be adversely affected. The tirade of abuse has already gone too far.

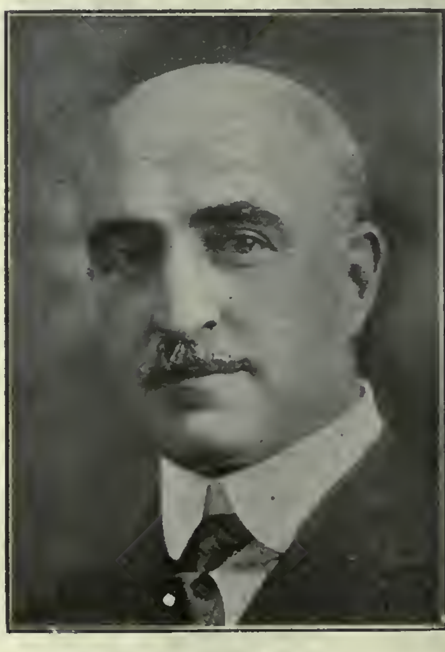
"In Canada, however, not only have we received no direct help and lead from the government in connection with planning for our industries after the war in the nation's interests, but a considerable section of our population is keeping the country in a foment of agitation which would tend to destroy rather than to build up.

"As far as export trade is concerned, manufacturers in Canada may be forced in the national interests to sell their wares at a merely nominal margin of profit so as to help preserve the balance of trade and at the same time give employment to the largest possible number of people. The crux of the situation calling forth denunciation of industry, we believe to be just here. Interested parties have poisoned the minds of agriculturists and other classes in this country and have led them to believe that the manufacturers not only received directly an enormous advantage from the tariff which they were not entitled to, and in consequence were making profits which were out of all proportion to the risks involved, but were also actuated by the most selfish motives. It is, therefore, opportune to say fairly, honestly and emphatically that the average net return from the investment of capital in industry is not more than it should be to encourage men to take the risks incident thereto.

Hostility to Manufacturers

"It would appear from the propaganda being waged with such vehemence against the manufacturers of Canada that the chief view presented is that the tariff is retained solely to benefit the manufacturers and to oppress all other classes of the people, the farming community in particular. It is, therefore, quite evident that the time has come when the manufacturers of this country can no longer keep silence, either in their own interests, the interests of labor, or the great national interests of this country. It should be remembered that the present tariff, with changes here and there, was enacted as a great national policy, not for the benefit of any one class, but for the well-being of the nation at large. Manufacturers feel that the tariff could and should be changed here and there, and so amended that it would apply more scientifically than it does at the present time.

"For this and other reasons the manufacturers would like to see created what might be termed 'a trade and tariff board,' such a board to be composed of



T. P. HOWARD

representative men of actual experience and wide knowledge of commercial conditions, and whose broad outlook and vision would fit them particularly for the proper study of these great questions so vital to our national interests."

Report of Tariff Committee

The report of the committee dealing with the United States embargo says in part:

"The tariff changes enacted by Parliament this year were designed wholly to meet revenue requirements, owing to the enormously increased government expenditure on the war. Your committee believes that no other action is practicable in the country's general interests, whilst the war continues.

"The mobilization work of the United States commands our highest admiration, but the very efficiency and nation-wide scope of this concentration on the one object of hastening the successful ending of the war has created temporarily critical conditions for this country, as in the case of war trade embargoes, which prohibit the exportation to Canada of various basic materials indispensable to essential industries.

U.S. Dominates Market

"Canadian industry has been built up in close relation with the growth of United States industry. We draw necessary materials from adjacent United States territory, just as an industry in one State draws materials from another State or from Canada. Now, however, a United States manufacturer is using materials which a Canadian manufacturer cannot obtain, and, in other cases a United States manufacturer is buying his basic materials at lower prices than the same materials, which are equally essential to his work can be purchased in the United States by the Canadian manufacturer.

"Since the United States still allows the product of such a manufactory, representing completely finished articles as sold to the ultimate user, to be exported to Canada, the manufacturers of that country are able to offer lower prices here than our manufacturers can meet. This works to create unfair domination of this market.

Complete Pooling of Resources

"The United States would be treating the Dominion of Canada no better than they treated it throughout the first years of this war, when they were a neutral nation, if they would arrange to admit Canadian manufacturers to their sources of supply under conditions which they apply to their own manufacturers. If Canadian industries were permitted to obtain indispensable materials in the United States on the same terms as govern their use by corresponding United States manufacturers this policy could not fail to produce better effort in the war work of North America. Full control of such equitable arrangements could be assured under regulations of the Canada War Trade Board.

"The effect of government encouragement to great imports of finished products from the United States seems to have been overlooked or disregarded. It increases the difficulty of the exchange situation resulting from the fact that the balance of our trade with the United States is heavily against Canada."

On the second day a number of interesting papers were read and officers for the year elected. The papers included one on Industrial Research, read by D. A. B. MacAllum, and "After-War Conditions," by the Hon. Frederic Nicholls.

Industrial Research

D. A. B. MacAllum, chairman of the Honorary Council of Scientific and Industrial Research, Ottawa, outlined the problems it is dealing with. He said:

"The only way to raise the vastly increased revenue due to the war was to develop the industries of Canada to the utmost."

He concluded: "I am not talking politics. I am not a free trader or protectionist. I do not wish to deride these questions. The question is, what are we going to do? We need revenue more than ever. How are you going to raise revenue without taxation? That is what one must do. Therefore this tariff question is now a live one, and it cannot be placed aside for other bigger and more important questions."

Prof. W. L. Goodwin, chairman of the Canadian section of the Society of Chemical Industry, followed with an ad-

W. J. BULMAN

dress on "Chemical Industry." He spoke of the intimate relation of chemistry to modern industry. In these days when manufacturing was carried on scientifically chemical control was the order of the day, and more and more it was becoming an underlying principle for manufacturers to seek the aid of the chemist in carrying on their business. So much was this so that the universities where chemists are prepared had been utterly unable of late years to meet the demand for graduates.

After-War Conditions

Senator Nicholls, of Toronto, spoke of preparation for after-war conditions, on which subject he has been extremely active. Since the war, he said, exports had increased 254 per cent., of which increase manufactures provided 50 per cent. more than agriculture. While the 404 million increase in agricultural exports was subject to but little taxation the 600 million increase in manufactured goods exported was subject to taxation and super-taxation. It had done much to enable Canada to bear her war burdens.

"But after the export trade passes with the war where are we going to get the money to pay the war bills? It is up to us and to the government of the day to give us a lead in making preparations to meet the conditions we will surely be called upon to face," he said.

"The only way to prepare for after-war conditions in retaining our export trade in articles we manufacture now or can adapt ourselves to manufacture as we did in the case of munitions is by co-operation between the government and the manufacturers. This would eliminate trade jealousies and secure the respect and prestige which a quasi-government organization always secures."

After reading his own correspondence with the Prime Minister and other members of the Cabinet, in which he urged the government to take action in preparing for after-war conditions, Senator Nicholls asked the association to pass a resolution supporting this campaign, which it did.

Officers Elected

The following officers were elected: W. J. Bulman, Winnipeg, president; T. P. Howard, Montreal, 1st vice-president; J. S. McKinnon, Toronto, 2nd vice-president.

The association passed the following resolution in reference to after-the-war industrial operations:

"That the Canadian Manufacturers' Association, in annual convention, resolve:

"That the Government of Canada be urged to take prompt action towards making provision for the past war trade conditions to the end that the present favorable balance of trade may be continued and that the employment of several hundred thousand people now in war industries may not cease.

"That this association is further of the opinion that the plan outlined and submitted to the government by the special committee of the Senate on the conservation of Canadian trade or some modification thereof would, if adopted, result in permanent benefit to the country at large and also be of material assistance in the financing of our great national obligations."

Resolutions were also adopted: (1) Favoring government assistance for industrial and scientific investigation as a number of concerns have guaranteed financial co-operation on a considerable scale for a period of years, provided government action is forthcoming; (2) urging municipal, Provincial and Dominion Governments to seriously consider the whole question of housing reform towards the increasing of adequate housing facilities and the increase of house ownership, and (3) recording the association's deep appreciation of the work of the Commission of Conservation.

Principles & Practice of Mechanical Sketching & Drawing-III.

Every Mechanic Should Know How to Make and Interpret Mechanical Drawings and Sketches of the Simpler Types—A Practical Course Prepared Especially For Younger Men and Newcomers in the Industry

By Terrell Croft

Application of Calipers and Squares

THE combination square is sometimes usual in obtaining longitudinal dimensions. It may be utilized as indicated by using the regular head on the blade. One end of the object being measured rests on a surface plate. The head of the square is pushed down on the blade until it indicates the exact value of the dimension desired.

Internal dimensions are measured with the inside calipers. Fig. 16 shows the draftsman setting his calipers to the inside diameter of a pinion. After the calipers have been set to the required diameter, the linear dimension corresponding thereto is obtained from the scale as in Fig. 17. The end of the scale and the tip of one of the caliper legs are held against a surface plate. At the other tip of the caliper leg the required dimension is read.

In measuring external diameters with a caliper the procedure is that explained graphically in Fig. 18. The draftsman, by turning the thumb nut on the caliper, alters the distance between the two legs until the tips just touch the circumference of the surface to be measured. The

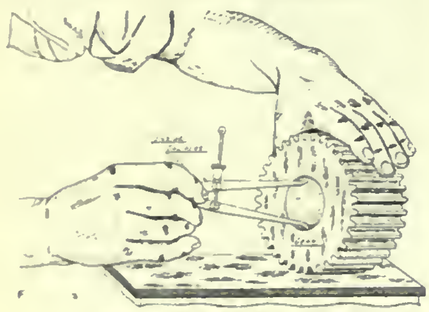


FIG. 16 USING INSIDE CALIPERS.

draftsman ultimately develops a sense of feeling in making these adjustments. With this sense of feeling properly matured, wonderfully accurate results are possible. The distance between the caliper tips having been made equal to that of the diameter required, the linear dimension is obtained as shown in and previously described in connection with Fig. 14 given last week.

External diameters of certain objects may be obtained with the combination square. This application is given in Fig. 19, wherein part of the object to be measured tapers. The use of the combination square on the surface plate insures that the diameter being taken is one at right angles to the longitudinal centre line of the object.

In determining the depth of a hole or slot the combination square fitted with the regular head can be utilized. In Fig. 20 is shown the method of obtaining the depth D of the slot in the object under consideration.

In finding the distance between centres of holes, where the holes are of equal diameter, the scheme shown in Fig. 21 can be applied. In some cases it will be

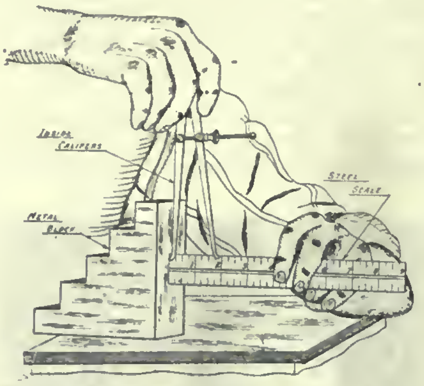


FIG. 17—METHOD OF READING INSIDE CALIPER SETTING

found that for this service the scale can be used as conveniently as can the calipers. That is, where the holes are of the same diameter, the centre to centre dimension is equal to that between the right-hand edge of one hole and the right-hand edge of the other. Where the holes are of unequal diameters, then the centre-to-centre distance equals the distance from right edge of one hole to left edge of the other plus one-half the diameter of each hole. To obtain the distance from an edge or surface of an object to the centre of a hole in it the procedure is this: Measure the distance from the edge or surface to the edge of the hole and add one-half the diameter of the hole to the distance thus obtained.

Using Combination Rule

In finding the centre of a cylindrical plane the combination rule equipped with a centre head is used as diagrammed in Fig. 22. Often it is necessary to thus

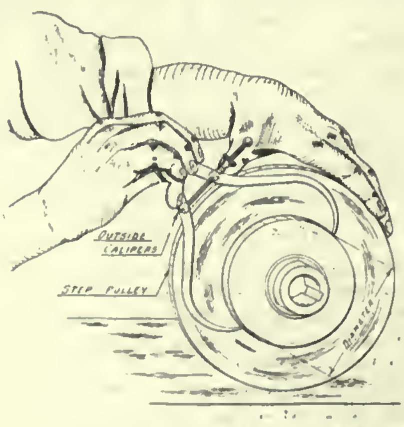


FIG. 18—FINDING AN OUTSIDE DIAMETER WITH OUTSIDE CALIPERS.

locate a centre so that radii may be determined therefrom. The rule with the centre head in position on it is first placed in the position AA and a line drawn across the end of the cylinder with the scriber. Then the rule—centre head in position—is turned to a location, BB, approximately at right angles to AA and another line is drawn. The intersection of these two lines will be the centre of the circle under consideration.

In measuring the angle of a beveled surface (Fig. 23) the combination square equipped with the bevel head is used. The head is rotated on its centre until when the blade and head are pressed against the surfaces under consideration the draftsman cannot see light between them and the surfaces or, at any rate, will see a line of light of equal thickness. Then the angle of bevel can be read from the protractor on the bevel head.

In taking measurements for lay-outs, that is, dimensions for plots for power-house or industrial plant drawings and plans, where the areas involved may be

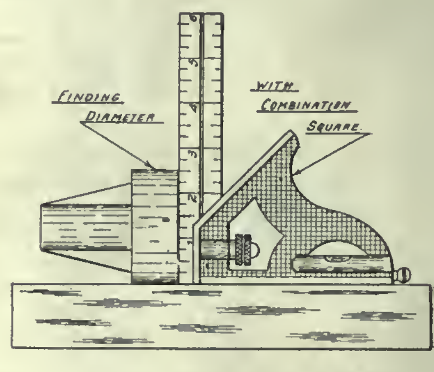


FIG. 19—USING COMBINATION SQUARE TO DETERMINE DIAMETER.

considerable, methods radically different from those described hereinbefore for relatively small objects must be used. That is, in lay-out work, the draftsman may deal in feet or even in hundreds of feet, rather than in inches. Hence, for taking the dimensions for lay-out sketches and drawings the tape line and the 6 or 8-foot folding rule are the instruments most commonly used. Often plumb bobs, for projecting down to the floor the locations of bearings, pulleys, shafts and similar members, are of great assistance.

Linear Dimensions

In recording linear dimensions in lay-out sketching the total distance from the starting point to the point under consideration, rather than the distance between points, should be recorded. This idea is shown in Fig. 24 which illustrates how the draftsman should enter on his sketch sheet or in his notebook the dimensions taken from the plot of the floor plan of an existing engine room. For example, at OF is the tape stretched to determine the locations of the window openings in the wall. The sketcher hooks the ring-end of the tape over the

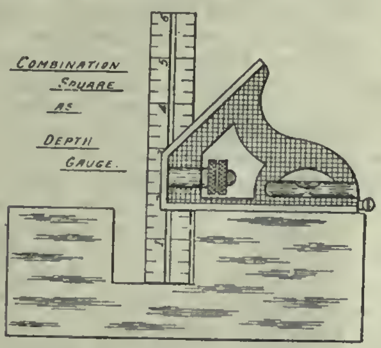


FIG. 20—USING THE COMBINATION SQUARE AS A DEPTH GAUGE.

nail at O and then proceeds along toward F, holding the tape taut. At each point which he wishes to locate on his sketch he reads the dimension from the tape. The dimension in every case is that between the point under consideration and the starting point O. For example, at A he reads 1'0", which means that A is 1 foot 0 inches distant from O. At point B he reads and records 3'6", which means point B is 3 feet 6 inches from his starting point, O.

Thus all of the points are recorded along the side of the room. When he returns to the drafting room and plots his lay-out to scale, he can obtain the dimensions for entry on his drawing in accordance with the usual method by subtracting successive dimensions from one another. The plan just described is the preferable one for lay-out work because it tends to eliminate errors. For example, if the sketcher were taking successive dimensions between points and

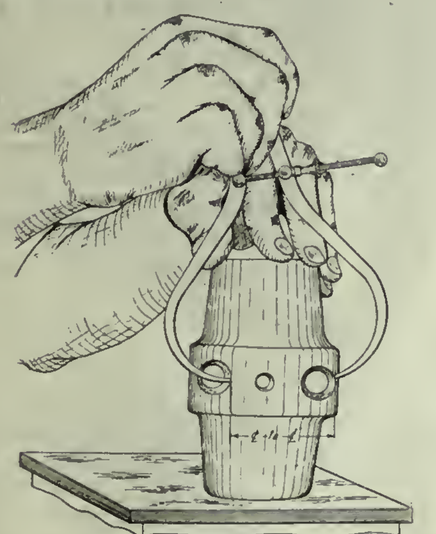


FIG. 21—MEASURING DISTANCE BETWEEN CENTRES OF HOLES ON A SQUARE BLOCK, WITH OUTSIDE CALIPERS.

measured incorrectly the distance OA in Fig. 24 it might render incorrect his entire sketch. But, if successive distances are read along the tape as explained even if several errors in observation or recording are made they probably will not cause trouble and can, in any case, be located readily. At GH in Fig. 24 is shown how the positions of the columns P, and P, could be recorded on the sketch. At IJ is shown how the location of the foundation F would be plotted. In Fig. 24 only the east and west observations are given. To complete the layout similar dimensions in the north and south directions would have to be taken.

TIME-STUDY

By A. W. Swan, B.A.Sc.

Every manufacturing plant has its own cost system, often very elaborate and held as a jealous secret; but when all is said and done any cost system boils down into knowing how long the various processes of manufacture take—and a careful assignment of the "overhead." All cost accountants will talk at considerable length of "overhead," machine-hour rate, and so forth, but it is surprising how many firms do not know the actual labor costs of their product, and here is where time-study comes in.

Time-study as a basis for bonus pay is well known, but all methods of bonus pay are for the purpose of increasing production by offering an extra reward, and it is very little use having a bonus pay system if there is no very well defined routing of work through the shop to avoid conflict of "rush" jobs. Right here time-study helps by giving the shop superintendent the knowledge of how long each process really takes, and by adding together the times for different operations dates for delivery can be set with considerable more accuracy than by the old—"Well, say the 20th of next month."

Type of Man Required

According to C. E. Knoepperl the "man for time-study must have tact, patience, accuracy, an analytical mind, a good imagination, constructive reasoning ability—which is rather a large order. But it is not quite such an easy job as the machinist is apt to think, and tact is certainly essential. For it is the task of the time-study man to get accurate operation times, to convince the men that it is to their own interest to work under a bonus plan, to be square to the men and yet not be led away into giving absurdly large "allowed times." He must avoid being fooled, and not lose his temper when he is, as he is sure to be sometimes.

Time-study will never work where the management is not trying to play square, but if the time-study is absolutely on the square, and the men begin to notice larger bonus amounts in their pay checks, they realize in a surprisingly short time that the company is not the only one to gain from a bonus system—and times will begin to get shorter—and with them of course the labor cost.

Time-study should by all means be open and above-board, the stop-watch soon becomes familiar to the operators, and there is no harm in telling them how the "allowed time" is calculated; in fact this has the advantage that the machinist can check up with his own observed time—and he usually will. Then the operator soon becomes convinced that all the time-study man wants is a good standard time, without hurry and without loafing. Of course, there are bound

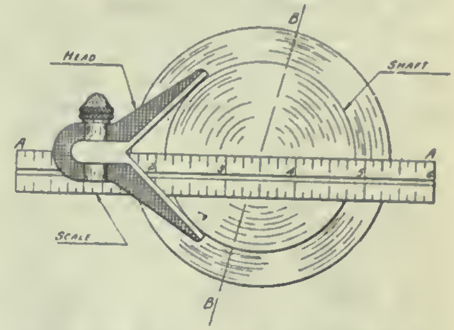


FIG. 22—METHOD OF FINDING CENTRE OF CYLINDRICAL OBJECTS.

to be attempts at trickery, but after a little experience they are not difficult to detect.

Taylor, Gantt, Bartth, and others have constructed slide-rules and charts for the guidance of the time-study man, advising him of proper speeds and feed for turning, drilling, etc.; but these should be used with considerable caution, as they usually represent the best practice with the best tool-steel, most convenient jigs and fixtures, and the most expert operators.

In the average shop these conditions are not found, and if used these rules should be adapted to local conditions by using a "shop constant" which the time-study man can work out for himself. In this connection it might be said that it is often a good plan to study the material provided by the makers of most machine-tools, who very often give

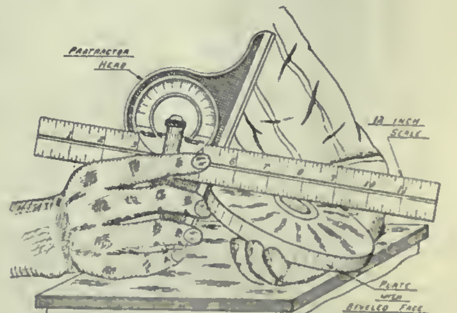


FIG. 23—METHOD OF DETERMINING ANGLE OF BEVEL BY PROTRACTOR AND SCALE.

speed tables and illustrate various "set-ups" in their instruction books.

Possibilities of Observations

Time-study certainly offers plenty of opportunity for anyone with a taste for research; in addition to working out ordinary machine times—comparing with the standard slide-rules, there is the matter of vise work; then time-study can be extended to the forge-shop and later, perhaps, even to the foundry. Then there is room for experiment with hack-saws—how the various makes of blades behave, how long they take to dull with rounds and flats, etc. But the largest field at present is certainly that which one might call "Elementary Handling Times." In the average machine shop there is no need to go the length of motion-study where every movement is analyzed, but the time-study man will find it a help to have a list of standard times for such motions as indexing the turret on a turret-lathe.

On the average machine-shop job on the lighter machines the handling time takes up a surprisingly large part of the total time on a job, and while it is easy to check up speeds and feeds, it is not so easy to check up the handling part of the work without some list of standard times.

As each time-study is made it should be filed, and should be easy of reference by having an alphabetical and numerical index. At the same time schedules should be made up for all machine-parts manufactured, having the operations in order. Then as the bonus system gets under way, and the average bonus made is known, it is a simple matter to know the actual time to expect on an operation compared with the allowed time, and hence to set delivery dates with certainty. Of course the actual average time for a large number of pieces on any operation will seldom be the studied time; it would be foolish to expect that it would, as there are always slight delays even to the best of workmen, and these should be allowed for in setting the "Allowed Time." However, there will be a fairly steady ratio between the allowed time and the actual average which can be used for date-setting purposes with very satisfactory results; and using the same information work can be laid out for a shop, assigning certain machines to particular jobs for a given number of days, and the work can be routed through the shop with far less delay than by the old method, and with a minimum of idle machines. At this point time-study connects up with the other important branch of modern production methods—routing and control—with which this article is not concerned directly.

It is highly important in all plants to have accurate labor-costs, and time-study will not give them directly, but if all the work is put on bonus and all time taken checked carefully, either by the time clerk or some mechanical system, the actual labor time and cost on every job is known, and comparison can be made in labor-costs as the lots go through.

It is advisable to keep records of times on all jobs, both for cost comparison and to see how time-study is affecting the plant. For estimating on new jobs time-study is absolutely invaluable, as no man can be on the job for any length of time without being able to estimate times for operations from drawings with considerable accuracy, and by adding together such times and allowing the average hourly rate in the plant, adding material cost and overhead as it is usually calculated, the cost estimate is not likely to be at all far out.

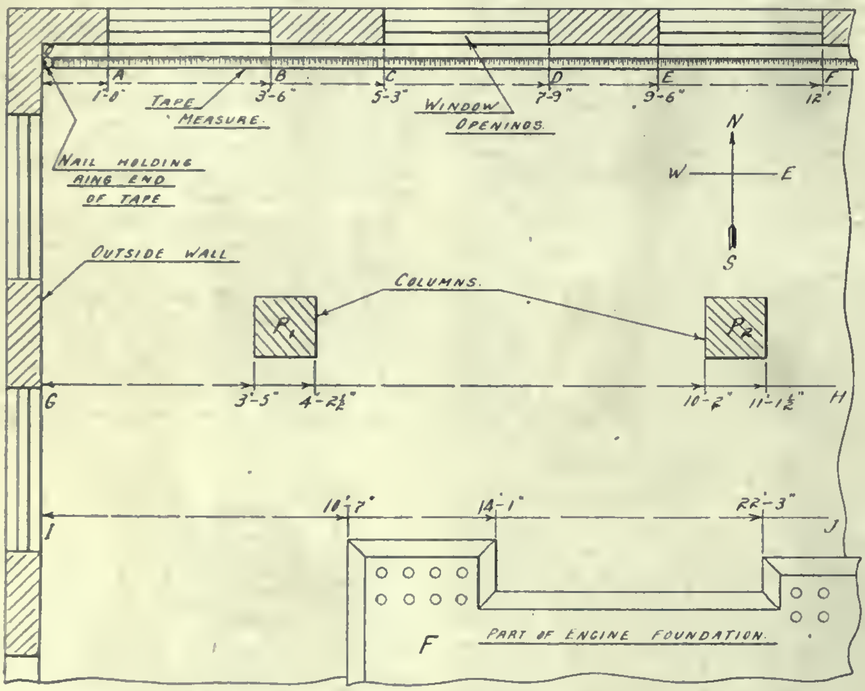


FIG. 9—CORRECT METHOD OF TAKING MEASUREMENTS BY STEEL TAPE.

ADVISORY RESEARCH COUNCIL FELLOWSHIPS AND STUDENTSHIPS

The Research Council was originally instituted to promote research in pure and applied science, and especially in those sciences which are related to the industries, so vital to a national prosperity.

Research in Canada has been largely suspended during the last three years except in a few of the leading industrial establishments and smelting plants. The staffs in the scientific departments of the universities have been greatly depleted by the enlistment of their members for military service, and those left, burdened with heavier teaching duties, have been unable except in a very few cases, to do more than carry out their routine duties. The effect of this on research work in Canada will prove to be very seriousfi unless measures are taken soon to supply the growing deficiency, for the interruption of the supply of recruits to the ranks of science must naturally curtail all research, both scientific and industrial, for many years to come. During the time of acute industrial pressure, often described as the "period of reconstruction," there will be so much demanding immediate attention that, inevitably, all questions of research will be pushed aside. Hence, the remedy is today not a matter of choice, but of necessity, for, if Canada is to maintain her position in the industrial world, she must immediately lay plans to maintain the supply of qualified men capable of carrying on those scientific investigations which produce new and sometines revolutionary methods and processes.

Research breaks up, roughly, into two main divisions: Research in the pure sciences and industrial research. It is impossible to draw a sharp line of demarcation between these two and he would be venturesome indeed, who would predict that a discovery in pure science would never be capable of industrial application, and, conversely, many discoveries of great note in the field of pure science have been made in industrial laboratories. Consequently, it is a traditional, rather than an actual, division that has been indicated.

In order to encourage in every possible way all branches of research in pure science, with special emphasis, of course, on those sciences which are likely to have industrial application, the council has instituted a large number of studentships and fellowships tenable at any of the Canadian universities, which are granted to graduates, or others, who, by their past records, have shown themselves capable of conducting scientific research. The studentships are of the value of $750 per annum, and the fellowships of $1,000 to $1,500.

To-day in the various Canadian universities there are, in spite of war conditions, eight students and fellows of the research council, who are actively engaged in investigations of importance to Canada. Among the subjects, which are of immediate public interest may be mentioned:

"Economic Utilization of the Tar Sands of Alberta."

"Utilization of Straw for Light, Heat and Power."

"Rubber Solutions and Colloids."

None of these researches has, as yet, been completed, but encouraging results have been reported by the investigators.

Copies of the exact regulations governing these studentships and fellowships may be obtained on application to the Secretary of the Research Council, Ottawa.

Vancouver. — The steel steamship Alaska, 8,800 tons, the largest steel steamship constructed in Canada, was taken from its launching berth Friday night. The trial trip of the vessel was made on Saturday.

WELDING A LARGE ALLIGATOR SHEAR FRAME

By J. H. Rodgers

ABNORMAL conditions are often mainsprings of unprecedented industrial developments, and these circumstances, coupled with the essential need of maximum conservation of certain materials, are undoubtedly important factors in expansion of many enterprises. The stupendous demand for iron and steel during period of war activities has almost if not entirely eliminated the so-called scrap pile; parts of machinery, and in some instances complete machines that in normal times would be considered as useless, have been given a new lease of life as a result of the great difficulty experienced in obtaining the required article in its initial state, from its original source. Probably no other agency in the wide field of engineering has done so much to reduce the size of the scrap heap as the art of welding, be it the blacksmith, the autogenous or the thermit process. Each method has its own particular sphere of usefulness, careful judgment being frequently necessary to determine which is the best system to adopt to meet the needs of the situation. However, it is reasonably safe to assume that for welds on heavy bulky sections of machinery the best practice to follow would invariably be the last mentioned, that of the thermit process.

An interesting repair by the thermit welding process was recently performed at the plant of the St. Lawrence Welding Co., of Montreal, views of which are shown in the accompanying illustrations. The casting here shown is that of a large steel aligator shear frame, broken through the central rib and the back housing, as a result of the upper jaw being forced sideways through careless work on the part of the operator. Owing to the inability of getting immediate delivery on a new casting it was decided to have the part repaired by welding, so the method here described was adopted and the repair successfully accomplished.

Preparation

In preparing the frame for welding it was located directly beneath a skylight to permit of free egress of the heat and gases, as the ceiling was low and of wood construction. Before proceeding with the placing of the mold, the oxy-acetylene torch was used to cut away the metal adjoining the crack, leaving a channel about two inches wide through the entire length of the broken portion; this being an essential feature in connection with welds of this character. The space thus provided is then filled with a special yellow wax which acts as the pattern; this wax is generally banked up above the ordinary level of the casting to provide additional metal at the broken section. This practice is not absolutely necessary, but where no interference will result the surplus metal is preferable as an added assurance of safety. During the preheating operation this wax is melted, leaving the hollow chamber for the fluid metal.

With the wax in position the sheet steel casing was placed over the broken portion in such a manner as would permit of placing the pouring gate and riser patterns in their desired location. This also applied to the heating gates, one of which was placed on either side and close to the bottom of the mold. Provision was made at the top of the mold in the form of a large basin, to carry the slag. When ready for preheating the crucible was supported above the mold by means of a girder placed across the skylight opening. The preheating apparatus, shown in the background of Fig. 2, is a Thermit gasoline compressed air unit for generating the gas required for the preheating of the broken section, preparatory to the actual welding operation. This particular type is provided with a device for removing the moisture from the air before the same mixes with the

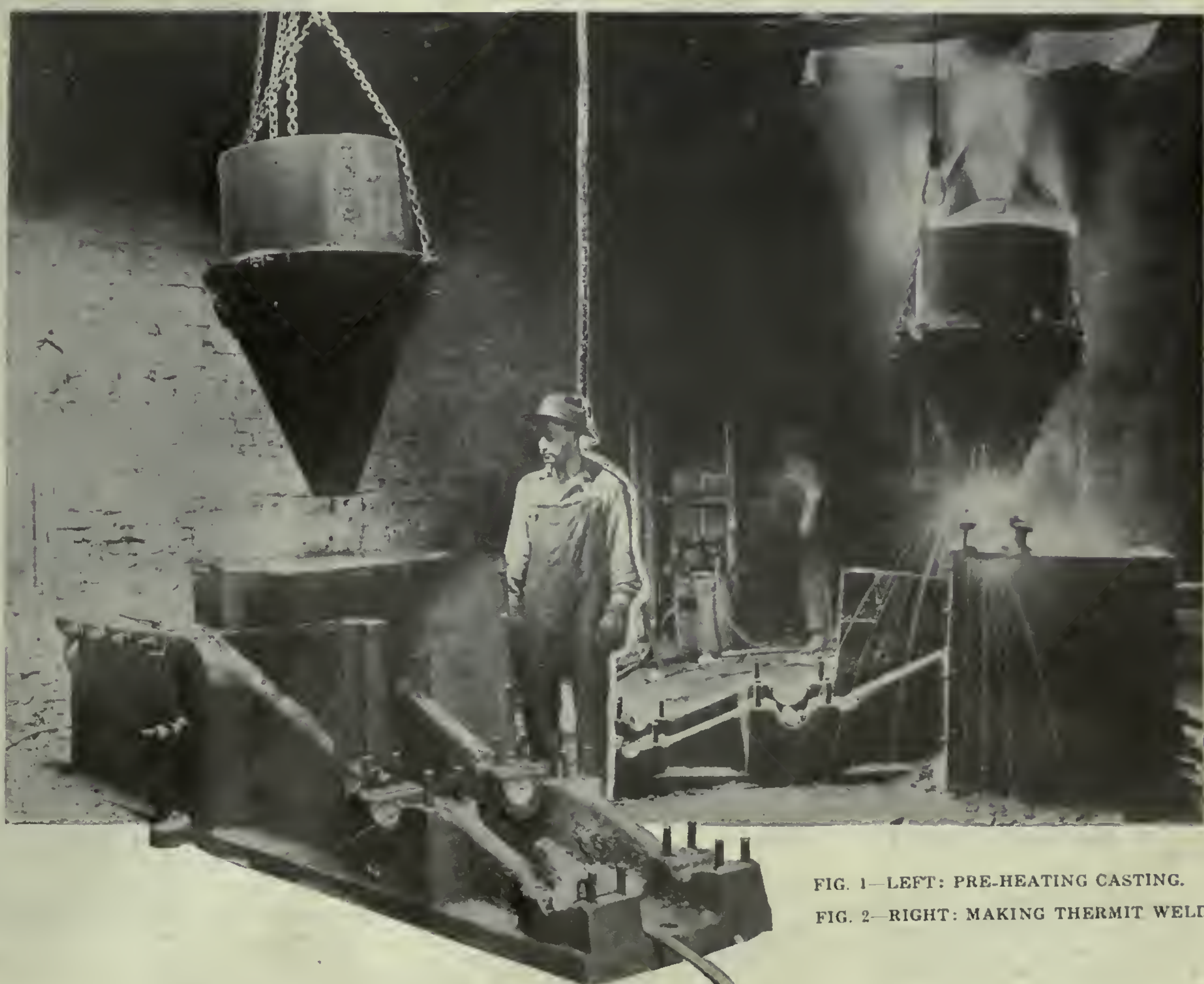


FIG. 1—LEFT: PRE-HEATING CASTING.

FIG. 2—RIGHT: MAKING THERMIT WELD.

oil; it is also equipped with two independent hose connections for operating two burners.

Preheating

The preheating on this job required considerable time, due to the heavy section of the broken portion and also to the fact that the pressure was insufficient to maintain a capacity flame at the heating gate. When the part was near the desired temperature the thermit—350 lbs. of which was required—was placed in the crucible, the latter being additionally supported on rails laid across the top of the molding frame. The burners were then removed and the heating gates plugged and banked with floor sand.

With everything in readiness the welder in charge places about one-half teaspoonful of the ignition powder on the top of the thermit in the crucible and then places the cone-shaped cover in position. A red hot rod is then inserted through the top of the cover and into the ignition powder, which is immediately ignited, and the chemical reaction is so rapid that within ten seconds the 350 lbs. of metal is converted into a molten mass at a temperature of over 5,000 degs. Fahr. In this particular instance, owing to the low heat of the casting before pouring, the metal was tapped less than ten seconds after ignition, so that the final stages of the reaction process would take place in the mold, thus assisting the fusing of the surrounding metal.

Detail Reference

Fig. 1 shows the work during the preheating operation, with the gas hose leading to either heating gate, and the crucible suspended in position. Fig. 2 shows the pouring process twelve seconds after the initial ignition. Fig. 3 shows a close up view of the finished weld with the pouring gate, riser, and one of the heating gates, before removal by the oxy-acetylene torch. The method of reinforcing the weld is clearly illustrated. The total weight of the casting was over 7 tons, and the completed weld was entirely satisfactory in every particular.

One of the great advantages of the thermit method of welding is the uniformity of expansion and contraction, a factor that is of vital importance in the greater number of machinery repairs, particularly where these are bulky and irregular in shape. The gradual rise in temperature during the preheating operation and the almost instantaneous distribution of the molten metal to all parts of the section to be welded virtually eliminates the possibility of internal stresses being set up in the material.

OPTICAL GLASS BEING MADE IN U. S. A.

Optical glass, although not required in large quantities, is nevertheless an item in war operations which is important because by optical instruments much of the firing. especially of artillery, is directed. If the men are not equipped with adequate fire-control instruments or can not see to aim properly, their firing can serve little purpose. A field army or a battleship without field glasses, telescopes and other optical instruments is manifestly placed at a serious disadvantage.

First Plant at Rochester

Before the war little effort was made to produce optical glass in the United States. Manufacturers of optical instruments were able to obtain optical glass in desired quantity and quality from Europe and consequently did not feel the necessity for making it themselves. In 1892, however, the Bausch & Lomb Optical Co., of Rochester, N.Y., built an experimental optical glass plant and placed a practical glassmaker in charge; by 1914 this company was able to produce a few types of optical glass which were used in optical instruments.

By the end of 1914 the importation of optical glass had become difficult and uncertain. Other firms, as Keuffel & Esser, of Hoboken, N.J., and Spencer Lens Co., Buffalo, N.Y., and the Bureau of Standards of the Department of Commerce, at Washington, began to experiment in making optical glass. By 1917, when the United States entered the war, the optical glass situation had become critical. The European supply was practically cut off. Optical glass had to be made in this country if our army and navy were to receive the fire-control instruments which they needed.

Produced in Quantity Now

The geophysical laboratory of the Carnegie Institution of Washington was called upon to aid in the production of high grade optical glass. A party from the laboratory was stationed at the plant of the Bausch & Lomb Optical Co. in April, 1917, and for seven months all efforts of the laboratory were concentrated at this plant. At the end of 1917 the essential details of the manufacture had been developed and glass in considerable quantities was being produced. The efforts of the laboratory were then extended to the Spencer Lens Co., and to the Pittsburgh Plate Glass Co., Pittsburgh, Pa. During this period the Bureau of Standards rendered effective aid.

At the present time, as a result of co-operation between the manufacturers and scientists, large quantities of optical glass of the kinds needed for military fire-control instruments are being produced of a quality equal in practically every respect to the best European glass. The need for a continuous and assured supply of optical glass is so great that the workmen trained in the details of manufacture and subject to draft are being withheld from draft in order that their technical training may be utilized at this time. The required information and details of manufacture and the skill necessary for proper production have been gained at great expense and under high pressure.

PROSPECTS OF ELECTRICAL INDUSTRY IN AUSTRALIA

Some interesting remarks on the present position and the future prospects of the electrical industry in Australia were made by the president of the New South Sales Section of the Electrical Association of Australia at its annual meeting held recently. He stated that the war had given a great impetus to the manufacture in Australia of electrical apparatus, and that large orders had been placed locally which would otherwise have gone abroad. Had the firms been quite prepared to execute the orders, they would have received a much larger volume of work.

Power is required for the development in New South Wales of large electro-chemical and electro-thermic industries, for which there is said to be a distinct field. It is probable that eventually the water powers of New South Wales will be harnessed in spite of the fact that coal is very plentiful, of excellent quality, and cheap.

Hydro-Electric Facilities

Considerable water power can be developed economically for the purpose of establishing manufactures, and the result of investigations shows that 100,000 kilowatts could be delivered on the sea-coast line, derived from the waters of the mountain ranges of the State.

This would enable producers to manufacture all products of the electric furnace, including not only steel, but carborundum and alundum as abrasives, graphite for electrodes, and to engage in the preparation of lubricants, calcium carbide for lighting, cyanide for fertilizers, alkali for all purposes, and, in all probability, aluminium.

There being no alternative—delivery being required soon—orders for electrical machinery have been placed with local manufacturers at exceptionally high prices.

When the war is over, however, the position will be altered. Active competition from established works abroad will be intensified owing to many manufacturing countries making a bid for the trade. Local factories will not be in a position for some years to manufacture on a large scale, and the only way of meeting this competition will be to impose a heavy protective duty or by reducing the cost of labor. A reduction of wages, however, is very unlikely.

MANUFACTURE OF WOOD-PULP IN THE STATE OF QUEENSLAND

The manufacture of paper pulp from Queensland soft woods has been commenced at Yarraman, Queensland. At present the manufacture is being conducted on a small scale and the pulp will be used by Sydney paper mills, which have already received 12 tons. The success of the operations is exciting keen interest in commercial circles.

A new industry is being started at Niagara Falls, Ont., by Lundy-Scott, Limited, who are now manufacturing collapsible fruit baskets, berry crates and egg crates, with new patent fillers. As a result of sending a sample to England, Lundy-Scott, Limited, received an order for two million baskets.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

HIGH-SPEED SHAPER

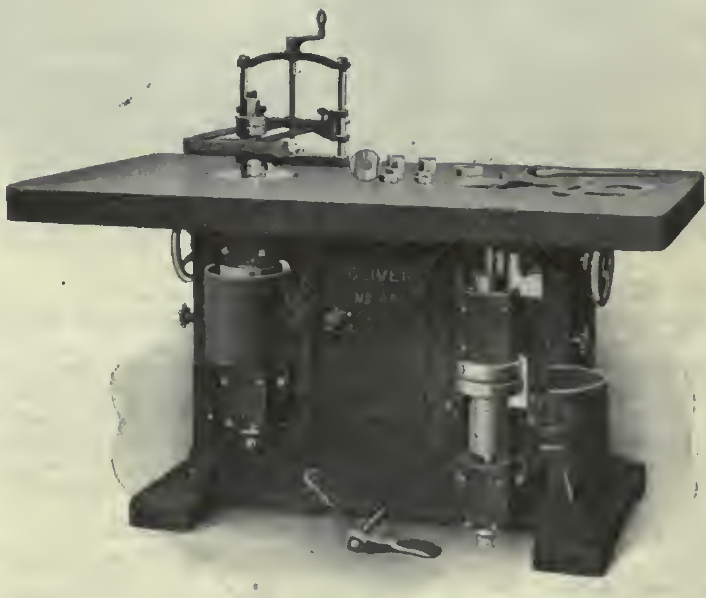
THE high-speed shaper illustrated is manufactured by the Oliver Machinery Co., Grand Rapids, Mich., and is well adapted to rabbeting, grooving, fluting, routing or shaping of any description.

The tables are large, very rigid, planed, and then accurately ground by a special process. They are bored out and fitted with three sets of rings, and are drilled and tapped for the guards.

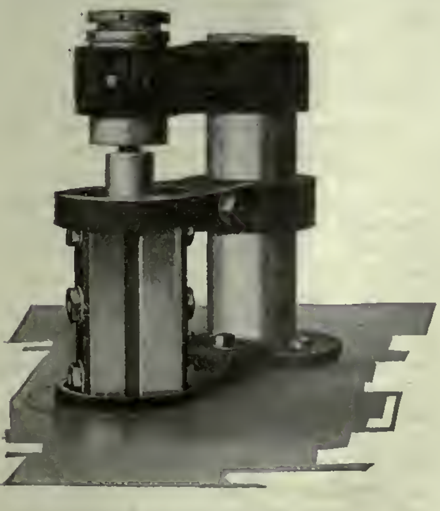
The spindles are tapered and are made of high carbon crucible machinery steel ground perfectly true on dead centres; guaranteed to run true. The spindles are regularly furnished to "run out."

The bearings are made of bronze, conical in shape, and are surrounded by oil chambers which lubricate the spindles the entire length of the bearings. The bottom of the spindle rides on a copper adjustable step, which is constantly washed with oil. A large brass drip cup catches the waste oil from the upper bearing. All adjustments are extremely simple.

Pulleys are carefully balanced, and are of the pneumatic type. The yokes are raised and lowered by means of the hand-wheels at the side of the machine, there being sufficient vertical adjustment to raise the spindle above the table or lower it beneath the tables. These yokes are very rigid and the screws for raising or lowering are directly in the rear of the spindle, affording them a direct support.



HIGH SPEED DOUBLE SHAPER.



EXTRA TOP BEARING.

The top bearings, with guides and supporting brackets are designed and particularly adapted to auto body or similar work. Top bearings are made of bronze and are adjustable. If desired these brackets can be furnished without the guides for furniture or column work.

A quick adjusting shaper guard is regularly furnished with each machine. Additional guards may be secured any time, as the tables are drilled and tapped for two guards. As shown by the illustrations, these guards are adjustable in all directions and are never in the way.

HORIZONTAL BORING MILL

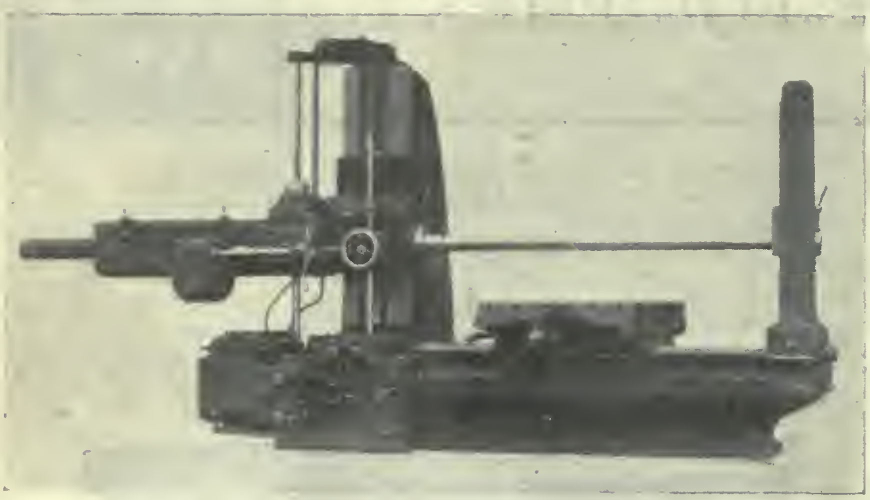
The illustration shows a recent product of the Defiance Machine Works, Defiance, Ohio. The boring mill illustrated is capable of a wide variety of work, being readily adaptable to milling, drilling and tapping operations in addition to the usual work performed.

The bed is of box construction, heavily cross ribbed, with the metal properly distributed to insure rigidity to all vital parts. The machine is entirely self-contained and rests on the floor at three points. The column is of box section flaring out at the bottom, to give a large bearing surface where it is bolted to the bed.

The spindle is of hammered high carbon steel, accurately ground its entire length, and slides through the spindle sleeve, while the spindle sleeve is a solid high carbon steel forging, with a conical journal at the front revolving in a solid bronze box, with an adjustable taper sleeve at rear. This arrangement makes it possible to take out all lost motion and permits the bolting of large milling cutters directly to a large flange on the end of spindle sleeve.

The spindle head has liberal bearing on the column, and instead of a narrow gliding edge on one side, the dovetail with taper gib is placed in the counter with actuating screw between. The two sides have clearance between the column, with straps at back. A gib on the front side is set up for free sliding fit, but helps to take any undue strain placed upon the head. A binder screw, back of the gib, locks the head rigidly to the column. The spindle head and tail block are raised and lowered together, being connected by a shaft and cut bevel gears. The tail block has long "V" bearings, which insures accuracy.

The spindle is driven through helical cut gears, which give the smooth motion to the spindle so essential in boring. Reversing with clutch is controlled by a lever convenient to operator, which makes it possible to use this machine for tapping.



HORIZONTAL BORING, MILLING, DRILLING AND TAPPING MACHINE.

The platen has large working surface with "T" slots of extra depth to insure strength. The gibbing to the saddle is of the square lock form, and a binder screw clamps the platen rigidly. A throw-out device regulates the movement of the platen. The saddle is extended out beyond the bed to give a good suport to the platen at its extreme point and rear positions. It is heavily gibbed to the bed and a tapered gib is provided for taking up.

The back rest carrying the tail block is mounted on a base, which contains the necessary mechanism. To accommodate long work, the back rest may be taken from the base by removing four screws without disturbing any of the mechanism and the base can be adjusted along the bed by means of a rack and pinion. A binding screw securely locks the base to the bed.

The feed is applied to the spindle in or out of the spindle head and tail block, up or down to the saddle along the bed and to the platen across the saddle. The two levers operate the shift with two sets of cone gears, four in one and three in the other, giving twelve changes of feed per revolution free of spindle. Another lever with convenient indexing device sets the spindle head, platen or saddle movement, giving the same feed wherever applied. A safety friction is placed in the feed box, which yields before any of the mechanism is damaged. It consists of a cast iron plate inside one of the feed gears, drawn up by a nut to the proper tension, and is applied at a point that it serves both in slow and fast travel. Fast travel to all parts having feed is obtained by a lever in a convenient position, giving the fast travel in either forward or reverse operation. Placed directly below is the lever for slow travel in either direction.

No countershaft is required with this machine, as it is a single pulley drive.

The spindle speeds are obtained by means of two cones of five hardened gears each, running idle ercept when one set is meshed by a roll-in hardened gear operated by a lever at the side of the machine within easy reach of the operator. These cones of gears are driven by back gears operated by a high-grade friction clutch located on the pulley drive shaft.

Hand adjustments are provided for movements of the spindle head, saddle and platen. The adjusting screws are all accurately cut, and are provided with dials graduated to one-thousandths of an inch in order to facilitate the production of accurate work

TRUCK FOR SHOP TRANSPORTATION

THE latest addition to the line of transveyors manufactured by the Cowan Truck Company of Holyoke, Mass., is their new Model G. This truck is of rugged construction and is a very easy elevating machine. The leverage is such that the maximum load can be readily elevated by one man. It is made in several sizes varying in capacity from 1,000 to 3,000 pounds. It is fitted with an improved locking device. This was chiefly designed to safeguard against the load becoming unseated when trucking over uneven floors. Various other improvements are incorporated in this new machine. The ease with which this transveyor elevates its maximum load, its quick operation make it particularly applicable to plants whose trucking requirements demand trucks of the abovementioned capacities.

TRACTOR TYPE TRUCK

The tractor truck illustrated herewith is manufactured by the Industrial Truck Co., of Holyoke, Mass. These tractors are manufactured in two types—an end control and a centre control—that is, a machine where the operator sits in the centre and can by changing seats operate in either direction without having to turn his tractor around. In congested or narrow aisles this is often a very valuable feature.

Either type steer on all four wheels and are built as two or four-wheel drive. The two-wheel drive machine can be converted to a four-wheel drive by the owner by purchasing the necessary worm and wheel housings, differential, etc.

The frame is built up of commercial rolled channel section steel; the bumper plates are of heavy boiler plate, bent on the corners and riveted solidly to the frame. The coupler castings are of the 3-step type to accommodate different heights of trailers. Battery boxes are constructed with easily removable side doors for changing batteries and hinged top plates for easy access for flushing or inspection.

Any type of battery can be supplied up to a maximum of 42 cells A8 Edison or 24 cells 21 plate lead.

The frame with battery box can be lifted from chassis by removal of four nuts, leaving entire driving mechanism accessible for inspection and repairs.

Power is transmitted from the motor through a single reduction worm and

TRUCK FOR SHOP USE

gear down through a differential and to the wheels by means of a rugged universal joint capable of operating at an angle of 43 degrees. This universal joint is enclosed in a patented dust and oil-proof case formed by the pivoting wheel knuckle and its supporting yoke.

The wheel bearings are of the ball type of the highest grade and, due to the fact that the universal joints can be drawn out through the full floating, mounting of the wheel are immensely over-size. Pivot bearings of a suitable size are provided, which renders steering easier than most pleasure cars.

Two separate brakes are provided—the one operated by the left foot being the emergency brake and that by the right foot the service brake. All brake rods are adjustable.

To operate the tractor the operator must be sitting in the seat with his left foot pressing the emergency brake pedal down. Every time his left foot is lifted from the brake pedal the brake is applied, bringing the machine to a stop and by means of a clutch on the controller shaft throwing the controller handle out of gear and the controller to neutral; it is then impossible to start the machine again without first releasing the emergency brake and bringing the controller handle back to neutral.

END CONTROL TYPE TRACTOR TRUCK

SENSITIVE BENCH DRILL

A new tool known as the "Dumore" Type A Drill is being put on the market by the Wisconsin Electric Company of Racine, Wisconsin. The machine is adapted for use by manufacturers and jewelers for light, sensitive work. The illustration shows the machine equipped with a direct connected variable speed type of motor, together with a No. 1 Jacob's chuck and a six-speed controlling

SENSITIVE BENCH DRILL

unit, affording speeds varying from 500 to 10,000 r.p.m. The controller is placed on the floor and is regulated by a foot pedal.

A wide range of operations may be conveniently handled with this drill, as it may be used with entire satisfaction on steel, cast iron, brass, aluminum, fibre, hard rubber, etc. The table is adjustable and gives the drill a stroke of ½ in. The capacity of the machine is for drilling holes up to 1-16 in. in diameter in steel and ⅛ in. diameter in soft alloys. Holes can be drilled to the center of a 5 in. circle. The motor and chuck are in perfect dynamic or running balance, thus assuring smoothness of operation and accurate results.

RAPID PRODUCTION LATHES

THE accompanying engraving shows a rapid production lathe now being built in 14 in. and 16 in. sizes by the Hamilton Machine Tool Co., Hamilton, Ohio. They are designed to meet the requirements of modern high-speed tool steel, and possess features imparting maximum power and accuracy for their size.

Accuracy and durability are sought through the use of an improved gear box, semi-steel bed with wide V box type headstock, chrome-nickel steel spindle and double apron with drop-forged gears. Friction has likewise been reduced to a minimum by the adoption of a central oiling system for the gear box and apron, sight-feed spindle oilers, and the use of bronze bushings for every running part.

The wide V on the bed is located well out in front so as to afford ample support to the tool carriage when working on large diameters. The design of the box head eliminates spring and vibration and causes the thrust to be taken by both front and rear bearings. Both sizes of lathe are regularly provided with single back gears and 4-step cone for 3-in. belt.

The hollow spindle runs in phosphor bronze boxes, scraped to a bearing and fitted with sight-feed oil cups. A special ball thrust bearing is located against the inside of the rear spindle box with take-up nut on outer end of spindle.

The extra heavy tailstock is secured by two clamping bolts, and has a plug binder for the spindle which is graduated in eighths of an inch. It is also provided with micrometer dial for fine adjustments.

An extra wide cross slide is fitted to the carriage. The latter has a bearing on the front and rear vees and also on the flat way in front. The compound rest is a semi-steel casting and is provided with taper gibs on both top and bottom slides. The chasing dial is set flush with top of carriage and can be disconnected when not in use to avoid wear.

All the shafts in the double box apron are hardened and ground, and the gears have the recognized safety arrangements. The length feed has an automatic knock-out and the apron hand-wheel is graduated in 64ths of an inch.

Forty-eight different threads and feeds are available with the regular set-ups of the quick change gear, while the open-end lead screw enables any thread to be readily obtained by the use of extra gears.

The principal dimensions are respectively: swing overshears, 16 in. and 18¼ in.; over compound rest, 9½ in. and 11¾ in.; length between centers on 6 ft. bed, 3 ft.; weight, skidded, 2,600 lbs. and 3,480 lbs.

LATHE DESIGNED FOR RAPID PRODUCTION

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Canada will have to raise $230,000,000 more in revenue now than she has ever done before. One of the ways to make that possible is by eliminating the waste wherever that is possible. Greater care will reduce the fire risk and in that way the insurance companies can afford to give a lower rate.

We have been so wealthy in Canada in the past that we have been prodigal of our resources. We did not even stop to consider a few millions loss in fire each year. "Well, it is gone. Let it go. We have lots more where that came from." That has been largely the attitude. But we have come to the stage where every leak must be stopped up.

THE MACHINIST COMES INTO HIS OWN

A FEW short years ago when a boy reached the age when he had to choose his life's work or have it chosen for him, the tendency was to avoid, if possible, anything savouring too strongly of manual labor, especially if it were accompanied by dirty hands, greasy overalls and the restriction of personal liberty during the day such as obtains in machine shops.

Frequently, however, some hereditary bent for mechanics would overcome these minor objections and many a bright young fellow was considered by his friends to have sacrificed himself for some useless ideal. Not for them was the steady grind, the pride of production, the satisfaction of seeing in concrete form the result of personal effort and manual skill.

No occasion in the life of the clean clothes brigade can equal the moment when the apprentice cuts his first thread in the lathe and fits it to the nut. All the work of the so-called business man who works in an office would resolve itself into the most hopeless drudgery if deprived of the product of machinists' brains. The fountain pen is produced in quantities by the screw-machine—the typewriter owes its development—the press work—the dictaphone is a straight machine shop proposition—the rubber stamp depends on the toolmaker and die-sinker for its low price—the very stationery on which the clerk expends his energy is made by and printed with excellent examples of the machinists' art, yet the overalls do not occupy the same social status as the pen and ink manipulator.

Natural vanity may have something to do with it as the average boy may prefer to be one of the staff with the conspicuousness that arises from small numbers rather than become one of the crowd in the shop, and yet it seems almost a truism to state that except ye be submerged ye cannot rise to the top.

There are instances where successful men in certain walks of life started halfway up the ladder, but the names to conjure with, and they are constantly increasing, are those of men who covered the whole gamut, frequently from floor sweeper up. The longer the climb, the stronger must be the will and determination—the halfway start has made more failures than the long crawl.

The part played by the machine shop and engineering works at the present moment overshadows everything else with the possible exception of the chemical and mining engineer. Shipbuilding is simply applied engineering knowledge—engine building, scientific instrument work and allied lines are all based on similar principles, but the machine shop of a more or less refined type is necessary before these principles can be usefully applied, and the fate of civilization, triumph, or destruction is being decided by the machine shop.

The number of shells and guns, the quantity of equipment, the area of ground cultivated, the ships built and traffic handled, in fact, the actual existence of nations is initially dependent from hour to hour and week to week on the skill of the machinist, the art of the foundryman, and the ingenuity of the tool-designer and builder.

Stress of circumstances has forced many strangers into the payrolls of machine shops, and after the war the place thereof shall know many of them no more, but such of them as have tasted of the real knowledge of work and production, of utilizing the mysteries of science through the medium of mechanics, will be unwilling to become again mere hewers of wood and handlers of ideas. Their remaining in the industrial world will be to the advantage of the trade as well as themselves and their presence will be a helpful stimulant to all those who have looked forward to the day when the machinist would come into his own and overalls would become a garb of honor, not a dress of drudgery.

YOU CAN'T FOOL NATURE

MORE than ordinary interest attaches to the report that the claims of the Armenian inventor named Giragossian have not been substantiated before representatives of the Federal Government. Some time ago the inventor claimed that he had discovered a fuelless energy-producer which would supply all the energy needs of the world and after a scene took place in Congress, that body was sufficiently impressed to pass a bill providing for a test which has just been completed.

Five of the leading scientists of the United States were selected by Secretary Lane from a list of fifteen submitted by Mr. Giragossian and only they and the inventor were in the room during the test.

The entire proceedings from the start have been quite out of the ordinary and much criticism has arisen in the technical press regarding the probable success of what many claim to be a fake.

Nature is absolutely just and cannot be fooled into giving something for nothing. The law of action and reaction finds almost more explicit demonstration in energy production than in any other field of physical science, and it would be strange, indeed, if some revolutionary method of power generation has remained in obscurity all these years while many of the cleverest brains in creation have been passing over, under, and round about its hiding place, only to be brought to light by some hitherto unheard of individual.

RAILWAY officials report that 50,000 tons of steel products are rusting at Vancouver awaiting shipment to Russian consignees who have apparently forgotten their existence. We can see no right, moral or otherwise, by which Russia is now entitled to receive from Canada supplies in the category of munitions of war.

ALBERTA HAS TAKEN BIG COAL CONTRACT, AND DEPENDS ON ALIEN ENEMY LABOR TO FILL IT

Alberta Coal Men Have Uncertain Prop in Aliens, While Whole West Waits For the Coal to Keep Them Warm During the Coming Winter

A great deal of attention has been given to the coal question in Alberta. In fact there is a serious proposition at the present moment. The Alberta operators apparently went to Washington, and put it up to the government and fuel controller that Alberta could heat Western Canada, and it was nothing short of waste to put American anthracite in that corner of the Canadian market.

United States was anxious to have any help that would save coal and took the Alberta coal men at their word, telling them to go to it and fill up the bins of that section of Canada from Winnipeg to the coast.

Alberta has undertaken a tremendous task, and assumed tremendous responsibilities. If they fall down it's hard to say just what will happen.

It's not a pleasant thing to face a winter in Western Canada with an indifferent coal supply.

A writer who has travelled extensively in the West, speaking of Lethbridge and its alien miner problem, states:—

Where "If" Comes In

So the operators insist on qualifying their statement that they can supply all the excess fuel Eastern sections may require with the provision, "if we get all the labor we want, continuously for the year," resolves itself ultimately into the problem which is controlled by the men of alien enemy birth.

For instance, here is a verbatim report from two different mines in widely scattered sections of Alberta, made to the government which is just now trying to ascertain the nationality of each miner in District 18. This is from the Rosedale mine, submitted June 18—Austrian, 89; Canadian, 20; Italian, 11; American, 10; English, 6; Scotch, 5; German, 3; Belgian, 3; Dutch, 2; Swiss, 2; Welsh, 1. West Canadian Collieries, Greenhill mine—Canadian, 35; English, 12; Scotch, 5; Irish, 2; Welsh, 3; French, 7; Serbian, 17; Belgian, 28; American, 4; Russian, 7; Austrian. 45; Swedish, 5; Danish, 1; Norwegian, 3; Spanish, 1; Polish, 16; Bohemian, 17; Italian, 109; Slavok, 1. Of these 133 are citizens, natives and naturalized and 190 unnaturalized.

The Alien Enemy

In the analysis of these figures the government is trying to ascertain just now the actual hazard of the alien enemy holding up the production of coal in this crisis. The truth is that many mines and much property indirectly connected with the mining industry was owned outright by Teutonic individuals or companies when hostilities started. Some have managed to conceal their identity and their connections and others hurriedly transferred their interests, but the chief influence Austrians and Germans exert in these mines to-day is that they are relied upon to actually dig the coal. As John T. Sterling, inspector of mines for the province, asserted to the writer recently, "we could not mine twenty-five per cent. of the required supply this year without the active aid of the alien enemy miners. That's the reason we are forced to handle these miners with so much care."

But can human ingenuity invest this problem with an atmosphere that will enable the government to say specifically, "these alien enemies will work as required?" Every operator and laborer and business man and official with whom the writer has talked during two weeks of conscientious first hand investigation on the surface and in the mines forces the same answer—"no." It is a hazard and one the country must accept.

A. L. Smith's Plea

Here is a copy of a telegram that illuminates this alien enemy question. It was sent by Arthur L. Smith, of Calgary to Hon. A. L. Sifton at Ottawa, February 16, during the great strike crisis that threatened the whole mining industry: "I spent the day in the Rosedale camp. They have an efficient plant, pay high wages, excellent accommodation for men and have good board. Men in camp were quite contented, refusing to organize a union when solicited but were practically coerced by mobs from other mines composed largely of foreigners, sixty per cent. of whom are alien enemies. Troubles arose between the management and these outside alien enemies, subsequently all Rosedale miners went on strike tying up the whole field. I discussed matter with some of the miners who are anxious to go back but fear the union. Government must act shortly, either compelling management to accept the union or compelling men to work. If former, public sentiment, which runs high here on this alien enemy question, will be tremendously stirred; if latter, will be real step toward handling fuel situation. The problem in Alberta is very grave, affecting as it does the whole alien enemy question. Mounted police will corroborate all facts."

What Happened?

Smith is a prominent business man in Calgary and interpreted well the sentiment of the people on the alien enemy issues. The government acted very promptly through W. H. Armstrong, the federal administrator of the operators. He ordered the management to install the miners and specifically to re-employ an alien enemy named Vausman and to give him the identical team he was driving at the time of the strike—no other team!

Therefore the alien enemies triumphed and they at once got an exaggerated idea of their strength.

The docility of these alien enemies has not been improved by the events of recent date on the fighting fronts. They become more arrogant as they hear reports of German successes. This is one factor of genuine peril. But the whole fuel question is so complicated by selfish motives, business considerations, labor and transportation problems that it is baffling in its ramifications.

Making Big Money

Another Westerner, speaking of the alien labor problem in Western Canadian mines, says: "These men, by doing anything like a fair day's work, can make from $12 to $15 per day, and these excessive wages are tacked on to the consumer; $6.00 per day should be the limit these men should earn while our Canadian soldiers' wives, out of their meagre allowances, are trying to save enough to pay for their next winter's fuel. These alien miners are rolling in money at the present time and work when they think they will. Any mine manager will tell you that 80 per cent. of his troubles is due to the men."

One of the hard things to combat among the foreigners in the mines of Alberta, or British Columbia, is the fact that they do not speak our language. They are in many cases under the influence of a leader of their own whose one motive is to grab off every dollar in any way he can. Although much has been done to combat the practice, it has been in many a Western town, where a large amount of foreign labor was required, a common practice of these foreign leaders to accept the "palm money" of the poor foreigner to "get him a job," when all the time the job was there spoiling for some person to go and get busy on it.

The foreign problem in mining in Canada has always been a serious one—but just now with a winter coming on, and with a great stretch of territory, not quickly covered by transportation facilities, depending on these miners for their coal supply, it is not too much to call the situation critical and dangerous.

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Frequently, however, some hereditary bent for mechanics would overcome these minor objections and many a bright young fellow was considered by his friends to have sacrificed himself for some useless ideal. Not for them was the steady grind, the pride of production, the satisfaction of seeing in concrete form the result of personal effort and manual skill.

No occasion in the life of the clean clothes brigade can equal the moment when the apprentice cuts his first thread in the lathe and fits it to the nut. All the work of the so-called business man who works in an office would resolve itself into the most hopeless drudgery if deprived of the product of machinists' brains. The fountain pen is produced in quantities by the screw-machine—the typewriter owes its development—the press work—the dictaphone is a straight machine shop proposition—the rubber stamp depends on the toolmaker and die-sinker for its low price—the very stationery on which the clerk expends his energy is made by and printed with excellent examples of the machinists' art, yet the overalls do not occupy the same social status as the pen and ink manipulator.

Natural vanity may have something to do with it as the average boy may prefer to be one of the staff with the conspicuousness that arises from small numbers rather than become one of the crowd in the shop, and yet it seems almost a truism to state that except ye be submerged ye cannot rise to the top.

There are instances where successful men in certain walks of life started halfway up the ladder, but the names to conjure with, and they are constantly increasing, are those of men who covered the whole gamut, frequently from floor sweeper up. The longer the climb, the stronger must be the will and determination—the halfway start has made more failures than the long crawl.

The part played by the machine shop and engineering works at the present moment overshadows everything else with the possible exception of the chemical and mining engineer. Shipbuilding is simply applied engineering knowledge—engine building, scientific instrument work and allied lines are all based on similar principles, but the machine shop of a more or less refined type is necessary before these principles can be usefully applied, and the fate of civilization, triumph, or destruction is being decided by the machine shop.

The number of shells and guns, the quantity of equipment, the area of ground cultivated, the ships built and traffic handled, in fact, the actual existence of nations is initially dependent from hour to hour and week to week on the skill of the machinist, the art of the foundryman, and the ingenuity of the tool-designer and builder.

Stress of circumstances has forced many strangers into the payrolls of machine shops, and after the war the place thereof shall know many of them no more, but such of them as have tasted of the real knowledge of work and production, of utilizing the mysteries of science through the medium of mechanics, will be unwilling to become again mere hewers of wood and handlers of ideas. Their remaining in the industrial world will be to the advantage of the trade as well as themselves and their presence will be a helpful stimulant to all those who have looked forward to the day when the machinist would come into his own and overalls would become a garb of honor, not a dress of drudgery.

YOU CAN'T FOOL NATURE

MORE than ordinary interest attaches to the report that the claims of the Armenian inventor named Giragossian have not been substantiated before representatives of the Federal Government. Some time ago the inventor claimed that he had discovered a fuelless energy-producer which would supply all the energy needs of the world and after a scene took place in Congress, that body was sufficiently impressed to pass a bill providing for a test which has just been completed.

Five of the leading scientists of the United States were selected by Secretary Lane from a list of fifteen submitted by Mr. Giragossian and only they and the inventor were in the room during the test.

The entire proceedings from the start have been quite out of the ordinary and much criticism has arisen in the technical press regarding the probable success of what many claim to be a fake.

Nature is absolutely just and cannot be fooled into giving something for nothing. The law of action and reaction finds almost more explicit demonstration in energy production than in any other field of physical science, and it would be strange, indeed, if some revolutionary method of power generation has remained in obscurity all these years while many of the cleverest brains in creation have been passing over, under, and round about its hiding place, only to be brought to light by some hitherto unheard of individual.

RAILWAY officials report that 50,000 tons of steel products are rusting at Vancouver awaiting shipment to Russian consignees who have apparently forgotten their existence. We can see no right, moral or otherwise, by which Russia is now entitled to receive from Canada supplies in the category of munitions of war.

ALBERTA HAS TAKEN BIG COAL CONTRACT, AND DEPENDS ON ALIEN ENEMY LABOR TO FILL IT

Alberta Coal Men Have Uncertain Prop in Aliens, While Whole West Waits For the Coal to Keep Them Warm During the Coming Winter

A great deal of attention has been given to the coal question in Alberta. In fact there is a serious proposition at the present moment. The Alberta operators apparently went to Washington, and put it up to the government and fuel controller that Alberta could heat Western Canada, and it was nothing short of waste to put American anthracite in that corner of the Canadian market.

United States was anxious to have any help that would save coal and took the Alberta coal men at their word, telling them to go to it and fill up the bins of that section of Canada from Winnipeg to the coast.

Alberta has undertaken a tremendous task, and assumed tremendous responsibilities. If they fall down it's hard to say just what will happen.

It's not a pleasant thing to face a winter in Western Canada with an indifferent coal supply.

A writer who has travelled extensively in the West, speaking of Lethbridge and its alien miner problem, states:—

Where "If" Comes In

So the operators insist on qualifying their statement that they can supply all the excess fuel Eastern sections may require with the provision, "if we get all the labor we want, continuously for the year," resolves itself ultimately into the problem which is controlled by the men of alien enemy birth.

For instance, here is a verbatim report from two different mines in widely scattered sections of Alberta, made to the government which is just now trying to ascertain the nationality of each miner in District 18. This is from the Rosedale mine, submitted June 18—Austrian, 89; Canadian, 20; Italian, 11; American, 10; English, 6; Scotch, 5; German, 3; Belgian, 3; Dutch, 2; Swiss, 2; Welsh, 1. West Canadian Collieries, Greenhill mine—Canadian, 35; English, 12; Scotch, 5; Irish, 2; Welsh, 3; French, 7; Serbian, 17; Belgian, 28; American, 4; Russian, 7; Austrian. 45; Swedish, 5; Danish, 1; Norwegian, 3; Spanish, 1; Polish, 16; Bohemian, 17; Italian, 109; Slavok, 1. Of these 133 are citizens, natives and naturalized and 190 unnaturalized.

The Alien Enemy

In the analysis of these figures the government is trying to ascertain just now the actual hazard of the alien enemy holding up the production of coal in this crisis. The truth is that many mines and much property indirectly connected with the mining industry was owned outright by Teutonic individuals or companies when hostilities started. Some have managed to conceal their identity and their connections and others hurriedly transferred their interests, but the chief influence Austrians and Germans exert in these mines to-day is that they are relied upon to actually dig the coal. As John T. Sterling, inspector of mines for the province, asserted to the writer recently, "we could not mine twenty-five per cent. of the required supply this year without the active aid of the alien enemy miners. That's the reason we are forced to handle these miners with so much care."

But can human ingenuity invest this problem with an atmosphere that will enable the government to say specifically, "these alien enemies will work as required?" Every operator and laborer and business man and official with whom the writer has talked during two weeks of conscientious first hand investigation on the surface and in the mines forces the same answer—"no." It is a hazard and one the country must accept.

A. L. Smith's Plea

Here is a copy of a telegram that illuminates this alien enemy question. It was sent by Arthur L. Smith, of Calgary to Hon. A. L. Sifton at Ottawa, February 16, during the great strike crisis that threatened the whole mining industry: "I spent the day in the Rosedale camp. They have an efficient plant, pay high wages, excellent accommodation for men and have good board. Men in camp were quite contented, refusing to organize a union when solicited but were practically coerced by mobs from other mines composed largely of foreigners, sixty per cent. of whom are alien enemies. Troubles arose between the management and these outside alien enemies, subsequently all Rosedale miners went on strike tying up the whole field. I discussed matter with some of the miners who are anxious to go back but fear the union. Government must act shortly, either compelling management to accept the union or compelling men to work. If former, public sentiment, which runs high here on this alien enemy question, will be tremendously stirred; if latter, will be real step toward handling fuel situation. The problem in Alberta is very grave, affecting as it does the whole alien enemy question. Mounted police will corroborate all facts."

What Happened?

Smith is a prominent business man in Calgary and interpreted well the sentiment of the people on the alien enemy issues. The government acted very promptly through W. H. Armstrong, the federal administrator of the operators. He ordered the management to install the miners and specifically to re-employ an alien enemy named Vausman and to give him the identical team he was driving at the time of the strike—no other team!

Therefore the alien enemies triumphed and they at once got an exaggerated idea of their strength.

The docility of these alien enemies has not been improved by the events of recent date on the fighting fronts. They become more arrogant as they hear reports of German successes. This is one factor of genuine peril. But the whole fuel question is so complicated by selfish motives, business considerations, labor and transportation problems that it is baffling in its ramifications.

Making Big Money

Another Westerner, speaking of the alien labor problem in Western Canadian mines, says: "These men, by doing anything like a fair day's work, can make from $12 to $15 per day, and these excessive wages are tacked on to the consumer; $6.00 per day should be the limit these men should earn while our Canadian soldiers' wives, out of their meagre allowances, are trying to save enough to pay for their next winter's fuel. These alien miners are rolling in money at the present time and work when they think they will. Any mine manager will tell you that 80 per cent. of his troubles is due to the men."

One of the hard things to combat among the foreigners in the mines of Alberta, or British Columbia, is the fact that they do not speak our language. They are in many cases under the influence of a leader of their own whose one motive is to grab off every dollar in any way he can. Although much has been done to combat the practice, it has been in many a Western town, where a large amount of foreign labor was required, a common practice of these foreign leaders to accept the "palm money" of the poor foreigner to "get him a job," when all the time the job was there spoiling for some person to go and get busy on it.

The foreign problem in mining in Canada has always been a serious one—but just now with a winter coming on, and with a great stretch of territory, not quickly covered by transportation facilities, depending on these miners for their coal supply, it is not too much to call the situation critical and dangerous.

MARKET DEVELOPMENTS

War Contracts Are Being Placed for Very Long Terms--Some Run Until First of 1920

A Revival Noticed at Several Points in the Demand For War Purpose Machinery—Chains Are Up and Tendency is Still Higher—Many Ships Are Being Launched at Various Canadian Points

SHIPBUILDING can well be said to be attaining the summit of its growth in Canada. There is scarcely a week now that does not see a steel or wooden vessel taking to the water, and there are a large number of vessels under construction right now that will be ready to leave their berths in the next few months. The building of ships keeps up a steady demand for plate. In fact plate for this class of work seems to have the preference over anything else that is ordered from the mills in either Canada or the States.

Chains advanced quite sharply to the extent of $2 per hundred during the week, and the tendency is still higher. This is not stated to pave the way for a further increase, but there are market conditions that cannot be overlooked. Britain does not allow the hand-weld chain to be sent out any more, and there is in consequence a greater demand for the electric weld chain. The Emergency Fleet is also using a very large amount of this. Add to this the scarcity of raw materials passing to the chain plants and there is a situation that makes for higher values without much urging.

United States reckons apparently on a long period of warfare. At least it appears so from the contracts that have been placed for shells. The method of giving them out in renewals that are good for two months or so at capacity is not adhered to any longer. Some of the orders are for a year, others for a longer period, while two at least are known to guarantee shop capacity until the beginning of 1920.

There is a need still for men in many shops. Against this, however, it is reported from several centres that the labor problem is quite normal, and that little trouble is experienced in securing all the hands necessary.

Pig iron and good scrap material are scarce at either United States or Canadian points. The tendency to use large amounts of scrap at times brings trouble with a poor casting in foundry work, as the analysis of the scrap was not definitely known. United States War Board is just now taking steps to relieve this situation by having a survey made, nation wide, to secure reports on all material that could be scrapped to provide the necessary supply for the open hearth furnaces.

SHIPBUILDING ATTAINS ZENITH OF ACTIVITY—LAUNCHINGS NUMEROUS

Special to CANADIAN MACHINERY

MONTREAL, July 3.—The holiday season resulted in a quieter tone in the general situation, but actual production has as yet not been materially affected. Local interest is still centered in the renewal of the activity that has followed the placing of further orders for shrapnel shells, and this, together with the large contracts that have been let for American business, has been a wonderful factor in reviving an enterprise that showed a tendency to wane during the early part of the present year. In consequence of recent developments the requirements for machine tools has greatly increased, and the demands for accessory shop equipment have been exceedingly heavy. Both steel and wooden shipbuilding have attained the zenith of activity and launchings are now almost a weekly feature.

Steel More Settled

No marked change has been noted in the general steel situation and trading continues on virtually the same basis of that of the past several weeks. Dealers here are getting inquiries for steel that they are unable to fill owing to the regulation under which they are compelled to carry on business. The market is beginning to take on a more settled appearance as the trade realize that the present fixed prices on finished steel will remain unchanged. With all major operations practically under the control of the government approved bodies the recognized market is a thing of the past, and the sellers in many cases have become the buyers.

Plate requirements are on a par with those of shell steel, and mills are working to capacity to supply the ever-increasing demand. This has been emphasized recently in the States where the shipbuilding has been augumented by fabrication of steel at points apart from the erection site. While dealers here are contemplating a revision of their prices of certain materials they report no change over last week. The effect of the American advance in freight rates is not yet definitely known so that in some respect the situation here is unsettled.

Metal

The general metal situation has improved and the various markets have taken on a firmer tendency but price advances have not been marked. It was thought that the advance in freight rates would be a factor in the movement to higher levels of some of the metals, but the action of the American government in respect to steel prices has had the effect of steadying the markets, but notwithstanding the undertone is stronger on certain metals. Copper is steady but some nervousness is retained.

Tin is still a problem under the pronounced uncertainty. Spelter is firmer and may go higher. Lead is strong but quieter. Antimony and aluminum are steady and firm, the former with an undertone of strength over the increased demand for shrapnel.

Copper.—The situation is featureless

and operations are proceeding on a steady basis. Agitation is still evident in respect to a higher fixed price, but with the present figure ratified until the middle of August it is unlikely that even the argument of the higher freight rates will result in an early revision, and even when the present period expires the possibilities appear strong for a still further extension of the price now effective. Dealers here report unchanged conditions with the demand about normal, slight increase being noted for castings of copper. Prices remain firm at 29 and 30 cents per pound.

Tin.—Scarcity of visible tin has added renewed tension to the situation and offerings are not as free as the previous week. Little spot metal is available and sales are being made only on a future basis. New York nominal prices have taken on a firmer tone following the advance on the London market. Future positions are harder to obtain. Dealers here while anticipating no immediate advance are looking for continued firmness. Last week's quotation of $1.25 is still asked by most of the dealers.

Spelter.—The local situation has taken on a stronger tone as a result of the developments in the States where the market is considerably stronger. The consuming demand is little above normal but the supply has been reduced as the result of labor unrest at certain of the mines, this affecting the output of some of the American smelters. Dealers here are looking forward to a stronger market but present prices are on a par with those of last week.

Lead.—A comparative calm has apparently settled on the market as the active buying of the past week has been followed by a reluctant tendency on the part of consumers to cover future requirements. A steady demand is maintained on the local market but the price asked remains unchanged.

Machine Tools and Supplies

Machine tool activity is pronounced at the present time owing to the heavy dedand for shell making purposes. The renewal of shrapnel orders, after considerable of the old equipment has been diverted to the making of the American shells, has necessitated the replacement of many tools by those who are now working on the 18-pounders. The abnormal conditions that prevail in the States make it very difficult to obtain equipment from American builders so that the Canadian tool builders have been required to stimulate their output. Dealers here who have been unable to obtain required delivery of new equipment are acquiring all available used machinery suitable for their shell customers. The demand for ship working machinery has declined in volume but the requirements for small tools and supplies are as great as ever. Dealers report a heavy demand for all classes of small supplies and tools for shell production, and where these have to be brought in from the States the uncertain delivery is often very annoying.

Scrap Without Feature

Trading in scrap and old materials is continued in a quiet manner with nothing of interest to report. Conditions of handling the metal has changed greatly during the past year so that the dealers are not the factor they formerly were. Much of the dealing is now done direct from the producer to the consumer and in this way the dealer has practically been eliminated. Considerable busine- is still done in old machinery scrap for grey iron foundries, and the transactions in old metals are still carried on in fair volume. The present market, however, is one of firmness with quotations holding to the high level.

POINTS IN WEEK'S MARKETING NOTES

Launchings of ships, both steel and wood, are becoming matters of frequent occurrence in Canada, and the industry is reaching the summit of its capacity.

—

Most of the Ontario cities report that there is a fair supply of labor now. Some of the smaller centres find that it is hard to get and retain the more highly skilled men.

—

The agitation is still going strong in some centres for an increase in the price of copper, which is now fixed by the United States Government at 23½c per pound.

—

Some munition contracts placed in Canada recently have a stability to them that was unknown before. One of these orders will run a shop at 800 per day up to January 1, 1920.

—

American pig iron producers express satisfaction at the way the War Board is handling affairs. The pig iron men discussed many plans to make production greater and keep down costs.

—

Cool weather of the past fortnight has helped blast furnace operations to shove up production records.

—

There is a decided shortage of good scrap at United States points, especially anything in the line of good heavy melting steel.

—

A campaign is being carried on in United States to secure reports on all sources of available scrap in the country.

SHARP ADVANCE IN ALL SIZES OF CHAIN

And the Tendency of the Market is to Move to Still Higher Figure

TORONTO.—There is still one word that describes the busy state of trade in the machine tool, supplies and equipment business here, and that is "munitions." Dealers are up to their necks in business in many cases. Each plant that gets orders for new business wants to get production started as soon as possible, as the element of urgency and haste on the western front is transmitted in a large degree to the business passing here. Some contractors from this district are still visiting American points in connection with the securing of equipment. Canadian dealers have a very large volume of business just now, and they are working at considerable tension to cope with the situation.

The Upward Tendency

It was stated in these columns a week ago that there would soon be an upward revision of the schedule at which chains were being traded. It has taken place and the increase amounts to two cents a pound on all grades, either B, BB or BBB. There are some 185 varieties of chain made and sold on the market. In fact it is a business all by itself. The American industry has a very strong influence on the Canadian market both in regard to supply and price. Immense lengths of chain are being called for at the present moment for use in the emergency fleet, and there is the added element of excessive haste in the matter. The British government will not allow the export of the hand-made variety, for which there used to be such a demand. In fact there was a time when all the navies of the world specified British hand made chain on account of the purity of the iron used in them. Even the German navy used the British chain. There has been a big inroad made on this trade in recent years by the machine-welded product, makers of the latter claiming that there is a uniformity of strength that cannot be placed in a hand-made chain. Big quantities of hand-made chain were replaced by the machine-made variety in work on the Welland Canal, when it was found that the former was not standing up under the heavy strain in dredge work, e- Inch chain is quoted to-day at 14½c per pound against last week's price of 12¼c. and the dealer who sells it claims that he is not making as much as when it was listed at the lesser price as he cannot pass the increase in the entirety on to the consumer. In addition to the big demand the makers in the States claim that preference now goes to plate mills, and in consequence they are short of material. The tendency is for a higher price in chains, and this is likely to become more noticeable in the very near future.

Scrap Metals

There has been a fair volume of business passing in the second hand metal trade during the week, but there is absolutely nothing in the form of a feature in the whole situation. The situation in the American market is quite similar to that here at present. Steps are being taken now to have a survey taken of the scrap situation across the line, and circulars are being mailed to dealers inquiring the amount of stock on hand now and the amount they had a year ago. The inquiries also take in all lots of unprepared scrap that are being withheld from the market, principally in the form of obsolete railways, old mine heads and tipples which are not being operated, unused bridges or similar structures, old manufacturing plants not in operation—in fact any material which can be shipped to the scrap yard for preparation.

In Canada reports are sent out by dealers each month showing the amount of scrap coming into the yard and the amount sent out..

It may yet be found necessary to comb out the country to increase the amount of melting scrap coming into the market.

The high price of tin does not bring in any in the way of scrap. Tin stands very low in the amount of it that is recovered—in fact its principal use in that form is for the purpose of alloys.

There are no changes in prices being paid by dealers for scrap metals this week.

Non-Ferrous Metals

Canadian dealers are not much inclined to the belief that there will be a higher price set for copper in United States. The suggestion has been made that there will be two prices—one for the large producer and another or higher for the small mine. Early suggestions were that companies whose cost was above a certain figure should receive a premium over the lower cost properties. Now it appears that instead of having the cost the determining factor there is a possibility that companies turning out 10,000,000 pounds of copper or less each year will receive preferential treatment over the larger mines. The reason for such a course is not readily apparent, and it is hardly likely to come to pass.

Tin may yet reach higher levels, at least that is the latest word from New York markets. Price advances do not seem to have the effect of increasing the amount coming on the market. The only supposition is that there is none to be brought out.

MANY LARGE ORDERS STILL BEING PLACED

War Demands Are Still Reaching Ahead and Run Into Immense Sums

Special to CANADIAN MACHINERY

NEW YORK, July 3.—Shipbuilders, ordnance manufacturers, aircraft builders and a host of other industries engaged in war work, are constantly in the market for machinery, and many small orders have been placed during the past week.

Aside from the Bethlehem Shipbuilding Corporation, which is still buying machine tools and cranes heavily, most of the orders closed are of a miscellaneous character, but some large inquiries are coming from gun and shell manufacturers. The Watertown Arsenal wants a large number of machines for its motor carriage department for the manufacture of mobile gun carriages, and Bullard Engineering Works, Bridgeport, is buying additional equipment for its gun shop.

The Symington Machine Corporation has purchased equipment in the East for its large shell plant at Chicago, while the American Steel & Machinery Co., Pullman, Ill., has purchased the machinery necessary for its projectile factory in the Central West through the American Clay Machinery Co., Bucyrus, Ohio, which is the parent organization. The Wright-Martin Aircraft Corporation is preparing to purchase $1,500,000 worth of tools for its Long Island City plant, which will be equipped to produce fifty motors a day.

Crane manufacturers are receiving numerous small orders from shipyards, steel works, copper producers, electrical equipment manufacturers and from makers of pumps and war munitions. The New York Shipbuilding Corporation has issued a supplementary list for fourteen cranes, the American Car & Foundry Co. has closed for six cranes, and the Vulcan Iron Works, Wilkesbarre, Pa., has bought eight cranes. The General Electric Co. has ordered cranes for its West Lynn, Mass., and for its Schenectady, N.Y., plants. Among copper producers the Braden Co. has purchased conveying machinery, the Nichols Co. is taking bids on cranes, as is also the Michigan Copper & Brass Co. of Detroit.

The Carolina Shipbuilding Corporation has closed for $400,000 worth of machinery, some of which is already boxed ready for shipment to Wilmington, where fabrication of the steel for the fore-and-aft portions of twelve large steel ships of the Isherwood type will be built by the Government. The Emergency Fleet Corporation has just ordered 36,000 tons of steel for these ships, 15,000 tons of which will be shipped to Roanoke, Va., where the Virginia Bridge Co. will fabricate the plates and shapes for the midships and the remainder of the tonnage will go direct to Wilmington. The steel is to be delivered in thirty days, and the first keel will be laid in August. The Federal Shipbuilding Co. will build two additional ways at Kearney, making twelve in all. Additional launchings at this yard will take place speedily, and it is expected that twenty boats will be launched and that ten will be fully equipped and ready for sea service this year.

More Orders

Among the other manufacturers who have placed orders for machinery recently are the Worthington Pump & Machinery Corporation, which has bought tools for its Buffalo plant; the United States Cast Iron & Pipe Foundry Co. has bought cranes for its Scottdale, Pa., works, and the International Arms & Fuse Corporation, Bloomfield, N.J., which has bought machine tools. Railroads are still buying moderately; the Pennsylvania has revised its recent inquiry for cranes.

Government orders for approximately 250,000 tons of finished steel have been distributed by the War Industries Board, nearly half of which is for car construction. The Carnegie Steel Co. will furnish 50,000 tons of structural shapes and 40,000 tons of bars to the Pressed Steel and Standard Steel Car Companies. Sheet manufacturers have received orders for 15,000 tons of sheets for car construction and 60,000 tons of blue annealed and black sheets for export to France. Orders for about 20,000 tons of plain and barbed wire have also been distributed for shipment to France over the third quarter of the year. Independent plate manufacturers have received additional orders for 30,000 tons of sheared plates for ship work. The Railroad Ad-

LITTLE CEREMONY IN TAKING MEN IN U. S. FOR THE FORCES

"They are not standing on much ceremony in connection with the drafting of men for the army in some of the United States points," remarked a Canadian, whose business relations cause him to make frequent trips across the border, "nor does it seem to make a very great deal of difference what a man is working at.

"I happened to be in a shop in Bay City a few days ago," he remarked, "and while I was in conversation with the manager of the place the police van pulled up before the factory. Three or four officers went in and in short time came out with four young men. I was informed that this was not the first time it had happened. The men taken off by the police had probably not reported for the draft in which they were called. This shop was working on war orders, too, but not in a direct way."

The Canadian went on to explain that in many cases the shop that is doing work on a sub-contract is not getting war preference in the same way as it is being shown to the first contractor. In the instance to which he referred the shop was working on chucks, these to be supplied to a firm that was making war purpose machinery.

He was also impressed with the number of men there seemed to be in several of the United States points that he called at during the week. The labor situation in many of the points there is not nearly as acute as it is on this side of the line, owing to the much larger population, and the smaller proportion of it that has donned the uniform.

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		$32 75
Lake Superior, charcoal, Chicago		37 50
Standard low phos., Philadelphia		.....
Bessemer, Pittsburgh		37 25
Basic, Valley furnace		32 00
Government prices.		
	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

FINISHED IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	4 55
Steel bars, base, Montreal	4 50
Reinforcing bars, base	4 50
Steel hoops	7 50
Refined iron	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

	Montreal	Toronto
Lake copper	$30 00	$28 50
Electro copper	30 00	28 50
Castings, copper	29 00	28 00
Tin	125 00	125 00
Spelter	10 50	9 50
Lead	9 50	9 50
Antimony	15 50	16 00
Aluminum	50 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Effective Feb. 5, 1918.

	Black	Galvanized
Standard Buttweld		
	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 16	7 29
⅜ in.	5 16	7 29
½ in.	6 55	8 12
¾ in.	8 28	10 41
1 in.	12 24	15 39
1¼ in.	16 56	20 82
1½ in.	19 80	24 89
2 in.	26 64	33 49
2½ in.	42 72	53 53
3 in.	55 85	70 00
3½ in.	70 84	87 86
4 in.	83 93	104 10
Standard Lapweld		
2 in.	$ 29 60	$ 36 08
2½ in.	44 46	54 70
3 in.	58 14	71 53
3½ in.	72 68	90 62
4 in.	86 11	107 37
4½ in.	97 79	122 56
5 in.	114 00	142 82
6 in.	147 80	185 28
7 in.	192 80	241 57
8 L in.	202 50	253 75
8 in.	233 30	292 32
9 in.	279 50	350 18
10 L in.	259 20	324 80
10 in.	333 70	418 18

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES

4" and under, 45%.
4½" and larger, 40%.
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$19 00	$19 00
Copper, crucible	22 50	22 50
Copper, heavy	22 50	22 50
Copper wire	22 50	22 50
No. 1 machine composition	22 00	21 50
New brass cuttings	16 00	14 00
Red brass turnings	18 00	17 00
Yellow brass turnings	12 50	12 50
Light brass	10 00	9 50
Medium brass	12 00	12 00
Heavy brass	15 00	14 00
Heavy melting steel	24 00	21 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	34 00	30 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	26 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs	9 00	8 50
Cast borings	12 00	12 00
Stove plate	19 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	7 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 ... add	20
Machine screws, o. and fil. hd., brass ... add	25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ... plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws ... list plus	20
Collar screws ... list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ... add 40,	10
Cold pressed nuts to 1½ in. ... add	$4 50
Cold pressed nuts over 1½ in. .. add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 50
Solder, guaranteed	0 53
Babbitt metals	18 to 70
Soldering coppers, lb.	0 53
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	0 71
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	2 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular	0 12
Wood alcohol, per gallon	1 80
Whiting, plain, per 100 lbs.	2 20

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 00
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	8 65
Can. plates, all bright	9 50	9 50
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 20
Premier, 10¾ oz.	.....	9 50
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	37½
Disston	50
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod.	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .22
Acid, hydrochloric	off
Acid, hydrofluoric	.09½
Acid, nitric	.10
Acid, sulphuric	.03½
Ammonia, aqua	.14¾
Ammonium carbonate	.20
Ammonium, chloride	.40
Ammonium hydrosulphuret	.50
Ammonium sulphate	.30
Arsenic, white	.25
Copper, carbonate, anhy	.45
Copper, sulphate	.17
Cobalt, sulphate	.90
Iron perchloride	.20
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.65
Nickel sulphate	.35
Potassium carbonate	1.50
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.75
Sodium bisulphite	.25
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.18
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.18
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.18

Prices per lb. unless otherwise stated.

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CANADIAN MACHINERY
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Volume XX No. 2 July 11, 1918

Determining the Efficiency of Gear Drives*

Alden Absorption Dynamotor Used With Motor Suspended in Cradle—Both Field and Armature Free to Move—Results of Tests on Bevel Gears and Worm Drives Given in Charts

by C. M. Allen and F. W. Roys

APPARATUS for determining the efficiency of gears and other drives has recently been developed and used for making tests in the Mechanical Engineering Laboratories of the Worcester Polytechnic Institute. The fundamental principle of the apparatus consists in the direct measurement of the loss of power in the gear drive instead of the usual method of determining the input and output and subtracting one from the other.

2. Since the efficiency of good geared drives is relatively high, the input and output are very nearly equal, and any small errors in the measurement of these relatively large quantities will make a very large per cent. error in the difference, which is the power loss.

3. It is, therefore, evident that a method by which the loss may be measured directly and independently of the input and output would be very much more accurate.

Theory of Apparatus Used in the Tests

4. The theory of the apparatus which was used in the tests is as follows:—An electric motor is so hung in a cradle that both its armature and field are free to turn. The armature shaft is connected directly to the pinion gear shaft and the driven shaft directly to an Alden absorption dynamometer. The reaction of the motor field is balanced by the action of the absorption dynamometer through by a simple lever. The arms of the lever are accurately proportioned to the ratio of the gears.

5. The general idea of the apparatus is as follows:—An electric induction motor is hung in a cradle on double roller bearings, and an arm attached to the motor casing makes a cradle dynamometer. The motor shaft is connected directly to the drive shaft and an Alden dynamometer is put on the driven shaft. These dynamometers are so arranged that the force exerted by the end of the arms is downward. The arms of the dynamometers' are of equal length and at the end of each is a fixed knife edge. A lever with three knife edges mounted upon it has the two outer knife edges adjusted so that the distance between them is equal to the distance (horizontal) between the dynamometer knife edges. The third knife edge divides this distance into segments whose ratio to each other is the same as the gear ratio. These three knife edges lie in the same straight line. The lever is now placed directly over the line between the dynamometer knife edges, and is supported by the third knife edge which rests on platform scales. The end knife edges of the lever are connected to the dynamometers in such a way that the high-speed dynamometer is connected to the long arm of the lever. A counterweight and a rider weight are mounted upon the lever. See Fig. 1.

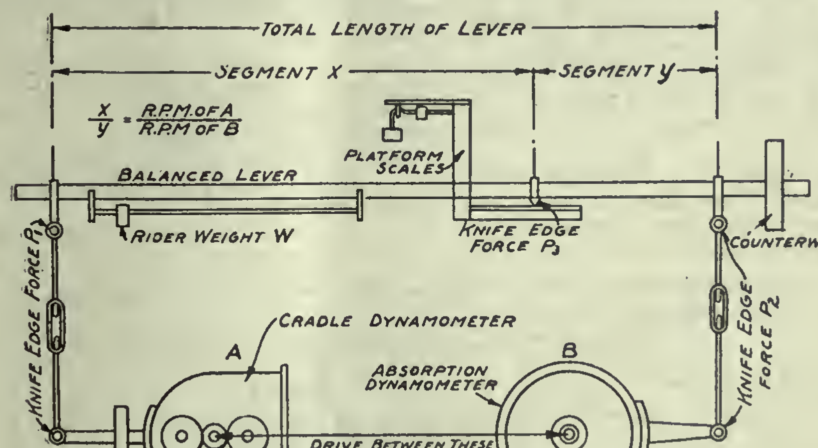


FIG. 1—APPARATUS USED IN MAKING TESTS.

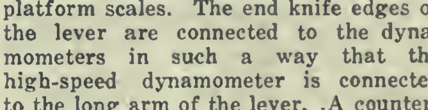


FIG. 2—DIMENSIONED SKETCH OF APPARATUS

Method of Testing

6. The method of testing, so far as the operation of the lever system is concerned, is identical for all tests, and therefore the explanation of its action is made perfectly general.

7. The centre of gravity of the Alden brake was very nearly in the horizontal plane, so that a slight movement of the arm did not measurably affect its balance. The cradle dynamometer was so loaded that its centre of gravity was only a short distance below the shaft centre, and a load of 2 lb. at the end of the arm was enough to entirely upset its equilibrium. The lever was then placed in position as described above and statically balanced by means of the counterweight shown in Fig. 1. A long pointer attached to the lever showed the

*Paper read before the spring meeting of the American Society of Mechanical Engineers.

position of the system relatively to the initial condition of balance.

8. When the rider weight W was in its initial position, the load P_3 (see Fig. 1) was noted as the initial reading of the platform scales.

9. The variables entering into the balance of this apparatus are then the forces P_1, P_2 and P_3, and the displacement of the rider weight. P_3 may be measured at any time while the apparatus is in operation and so may the displacement of the rider weight.

10. It should be noted here that the amount of P_3 has nothing to do with the calculation of the power loss, which is found as follows:

Method of Measuring Power Loss

11. It will be seen from the preceding description and from Fig. 1 that $P_1x = P_2y$ for 100 per cent. efficiency; but since the efficiency is never 100 per cent., P_1x must exceed P_2y by the amount necessary to overcome the loss in moment. This difference immediately upsets the balance of the lever, of course, but equilibrium may again be restored by shifting the position of the rider weight in the proper direction. This displacement of the rider weight is therefore a measurement of the change of moment, and when corrected for the speed of the apparatus it is a measurement of the power loss.

12. Here the input power is automatically balanced against the output and any little change in the latter is immediately taken care of by the motor, and it is impossible for the apparatus to be out of balance except by the amount of the transmission loss. This is the feature of the method which distinguishes it from all others.

13. The power transmitted by the drive may be computed by noting the change in the load P_3 on the platform scales, and such computations will be shown later.

14. In operation it was found necessary to start the apparatus and let it run for several minutes before taking note of the initial position of the lever. The zero reading was frequently checked during the period of testing.

Efficiency Test of Bevel-Gear Drive

15. Data of Gears and Apparatus. The gears were 5 per cent. nickel steel, case-hardened, 5 pitch, 1½-in. face. They were cut by the Brown & Sharpe Mfg. Co. and were mounted by them on ball bearings especially designed for testing purposes. Following are the preliminary data employed:

Number of teeth in gear, 52.
Number of teeth in pinion, 14.
Ratio, $52 \div 14 = 3.714$.
Total length of lever between outside knife edges (see Fig. 3), 3.95 ft.
Length of long arm of lever, 3.112 ft. = 37.344 in.
Length of short arm of lever, 0.838 ft. = 10.056 in.
Length of dynamometer arms, 31.5 in.

A force of 2 lb. at 31.5 is equivalent to 1 h.p. at 1,000 r.p.m., for which the expression 1 hp_{1000} will be used.

16. Calculation of Horsepower Loss from Movement of Rider. Referring to Fig. 3, a force of 2 lb. at $P_1 = 1$ hp_{1000}. Therefore 2×37.344 = inch-pounds of moment in lever necessary for 1 hp_{1000}, and if the rider weight is 3 lb., then for this to balance 1 hp_{1000}, 3x must equal 2×37.344, whence $x = 24.893$, and therefore a movement of 24.893 in. of the rider is equivalent to 1 hp_{1000} for a 3-lb. rider.

17. If the rider weighs but 1½ lb., then the same displacement means only ½ hp_{1000}. A paper scale was made according to these figures and was fastened to the lever. The readings for hp. loss were taken from it throughout the test.

18. Calculation for Horsepower Input. Referring to Fig. 2, since the initial load of P_3 was taken with the rider weight W already on the lever, a change in the position of W does not change P_3, but merely changes the moment. Therefore, in moment equations of the lever, regardless of where the centre of moments is taken, the arm of the moment of W is always the distance from the zero position.

19. The force P_1 is a measure of the input power if the speed is known, and it is merely necessary to calculate this value in order to solve the problem. Considering the moment equation of the lever, we have

$$0.838\ P_3 - 3.95\ P_1 + Wx = 0$$

whence

$$P_1 = 0.838\ P_3 + Wx \div 3.95$$

If $W = 3$ lb.,

$$P_1 = 0.2122\ P_3 + 0.759\ x$$

if $W = 1.5$ lb.,

$$P_1 = 0.2122\ P_3 + 0.379\ x$$

x being the displacement of W measured in feet.

20. Referring to Table 1, for accuracy of recorded data the values in column 5 (x ft.) and column 10 (rider hp_{1000}) should vary together since they both refer to the displacement.

21. Column 10 is recorded for one purpose and read from the paper scale directly in hp_{1000}, while column 5 is recorded for another purpose and the measurement is recorded in feet measured by an ordinary rule.

22. It is necessary to read the values recorded in column 10 with as great accuracy as possible, but the approximate distance to the mean position as determined in column 10 is as close as it is necessary to record the values of column 5.

23. The values in column 10 after correction for speed give the total loss in

TABLE 1 DATA OF EFFICIENCY TEST OF BEVEL-GEAR DRIVE

PRACTICALLY NO LUBRICATION

R.p.m. of motor	Scale pan, lb.	P_3 lb.	$0.2122\ P_3$	x ft.	$0.759\ x$	P_1	Input, hp_{1000}	Input, actual hp.	Rider hp_{1000}	Hp. loss	Output, hp.	Eff'y, per cent
1	2	3	4	5	6	7	8	9	10	11	12	13
1115	5	200	42.44	1.70	1.291	43.731	21.86	24 37	0.746	0.832	23.532	96.6
1112	5	200	42.44	1.70	1.291	43.731	21.86	24 37	0 810	0.903	23.467	96.3
1112	5	200	42.44	1.70	1.291	43 731	21.86	24.37	0.770	0.859	23.511	96.5
1112	5	200	42.44	1.70	1.291	43.731	21.86	24.37	0.820	0.914	23.456	96.3
1119	5	200	42.44	1.70	1.291	43.731	21.86	24.37	0.806	0.899	23.471	96.4
1146	4	160	33.95	1 25	0.949	34.899	17.45	19.92	0.660	0.753	19.167	96.2
1146	4	160	33.95	1.25	0.949	34.899	17.45	19 92	0 615	0.702	19.218	96.5
1141	4	160	33.95	1.25	0.949	34.899	17.45	19.92	0.620	0.708	19.212	96.4
1141	4	160	33.95	1.25	0.949	34.899	17.45	19.92	0.612	0.699	19.224	96.5
1138	4	160	33.95	1.25	0.949	34.899	17.45	19.92	0.610	0.696	19.224	96.5
1160	3	120	25.46	1.00	0.759	26.219	13.11	15 14	0.486	0.561	14.579	96.3
1150	3	120	25.46	1.00	0.759	26.219	13.11	15.14	0.490	0.566	14.574	96.2
1150	3	120	25.46	1.00	0.759	26 219	13.11	15.14	0.486	0.561	14.579	96.3
1150	3	120	25.46	1.00	0.759	26.219	13.11	15.14	0.484	0.559	14.581	96.3
1172	2	80	16.97	0.62	0.471	17.441	8.72	10.25	0.316	0.371	9.889	96.4
1172	2	80	16.97	0.62	0.471	17.441	8.72	10.25	0.310	0 364	9.886	96.4
1177	2	80	16.97	0.62	0.471	17.441	8.72	10.25	0.308	0.367	9.888	96.4
1196	1	40	8.49	0.40	0.337	8.827	4.42	5.26	0.196	0.234	5.026	95.55
1196	1	40	8.49	0.40	0.337	8.827	4.42	5.26	0.204	0.243	5.017	95.35
1190	1	40	8.49	0.40	0.337	8.827	4.42	5.26	0.204	0.243	5.017	95.35
1205	½	20	4.245	0.37	0.281	4.526	2.26	2.72	0.184	0.222	2.498	91.9
1205	½	20	4.245	0.37	0.281	4.526	2.26	2.72	0.184	0.222	2.498	91.9

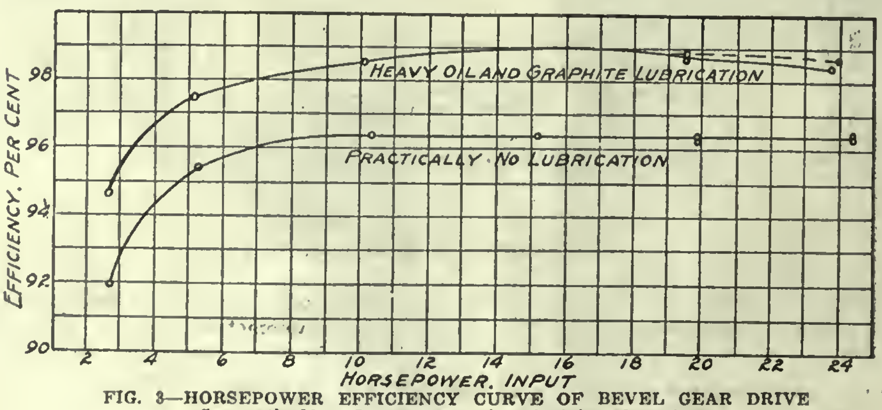


FIG. 3—HORSEPOWER EFFICIENCY CURVE OF BEVEL GEAR DRIVE
Gear ratio 26 to 7; revs. per min. of pinion about 1,200

TABLE 2 DATA OF EFFICIENCY TEST OF BEVEL-GEAR DRIVE

HEAVY OIL AND GRAPHITE LUBRICATION

R.p.m. of motor	Scale pan, lb.	P_3 lb.	$0.2122 P_3$	x ft	$0.379x$	P_1	Input, hp_{1000}	Input, actual hp.	Rider hp_{1000}	Hp. loss	Output, hp.	Eff'y, per cent
1109	5	200	42.44	1.25	0:474	42.914	21.457	23.72	0.330	0.365	23.355	98.4
1109	5	200	42.44	1.25	0.474	42.914	21!457	23.72	0.300	0.332	23.388	98.5
1109	5	200	42.44	1.25	0.474	42.914	21.457	23.72	0.302	0 334	23.386	98.5
1106	5	200	42.44	1.25	0.474	42.914	21.457	23.72	0.301	0.333	23 387	98.5
1106	5	200	42.44	1.25	0.474	42.914	21.457	23.72	0.303	0.335	23.385	98.5
1106	6	200	42.44	1.25	0.474	42.914	21.457	23.72	0.300	0.332	23.388	98.5
1139	4	160	33.95	0.90	0.341	34.291	17.145	19.49	0.228	0.259	19.231	98.6
1139	4	160	33.95	0.90	0.341	34.291	17.145	19.49	0.220	0.250	19.240	98.7
1135	4	160	33.95	0.90	0.341	34.291	17.145	19.49	0.225	0.256	19.233	98.6
1164	3	120	25.46	0.53	0.201	25.661	12.830	14.91	0.124	0.144	14.766	99.0
1164	3	120	25.46	0.53	0.201	25.661	12.830	14.91	0.124	0.144	14.766	99.0
1160	3	120	25.46	0.53	0.201	25.661	12.830	14.91	0.123	0.143	14.767	99.0
1175	2	80	16.97	0.50	0.189	17.159	8.579	10.08	0.120	0.141	9.939	98.45
1175	2	80	16.97	0.50	0.189	17.159	8.579	10.08	0.120	0.141	9.939	98.45
1175	2	80	16.97	0.50	0.189	17.159	8 579	10.08	0.120	0.141	9.939	98.45
1194	1	40	8.49	0.50	0.189	8.679	4.339	5.19	0.120	0.143	5.057	97.4
1194	1	40	8.49	0.50	0.189	8.679	4.339	5.19	0.120	0.143	5.057	97.4
1194	1	40	8.49	0.50	0.189	8.679	4.339	5.19	0.120	0.143	5.057	97.4
1200	½	20	4.245	0.50	0.189	4.434	2.217	2.67	0.120	0.144	2.526	94.6
1200	½	20	4.245	0.50	0.189	4.434	2.217	2.67	0.120	0.144	2.526	91.6
1200	½	20	4.245	0.50	0.189	4.434	2.217	2.67	0.120	0.144	2.526	91.6

power and become therefore the whole of the numerator of the equation for loss of efficiency, namely,

$$\text{Loss of efficiency} = \frac{\text{Hp. loss}}{\text{Hp. input}}$$

These values for hp. loss are recorded to three significant figures, but the third is somewhat in doubt, and therefore the absolute accuracy is only through two significant figures.

24. In figuring hp. input it is necessary to use the value P_1, which is obtained by means of the equation $P_1 = 0.2122P_3 + 0.759x$, where x is the value in column 5. The maximum variation in feet from the mean position (column 10) is less than 0.1 ft., but suppose that it was 0.1 ft.; then column 5 might have been 1.8 instead of 1.7 as in the first recorded line.

25. To see what the effect of such a discrepancy would be, the following computations have been made, taking x=1.8 and x=1.7, respectively:

$$P_1 = 200 \quad 0.2122\ P_3 = 42.44$$
$$P_1 = 42.44 + 0.759\,x$$
$$= 42.44 + (0.759 \times 1.8) \text{ or}$$
$$= 42.44 + (0.759 \times 1.7)$$
$$= 42.44 + 1.36 \text{ or} = 42.44 + 1.29$$
$$= 43.80 \text{ or } 43.75.$$

26 As hp_{1000} input $= \frac{1}{2}P_1$ then hp_{1000} equals either 21.90 or 21.865, and

$$\frac{\text{Hp. loss}}{\text{Hp. input}} = \frac{\text{Rider } hp_{1000}}{\text{Input } hp_{1000}}$$

whence

$$\text{Loss of efficiency} = \frac{0.746}{21.90} \text{ or } \frac{0.746}{21.855}.$$

27. It is thus seen that, measuring as accurately as possible, the numerator is only accurate to the second place, the third being in doubt; and that the second place in the denominator is sure and the third fairly sure, although considered in doubt. Therefore the denominator is as accurate as the numerator.

28. The numerator is as accurate as the apparatus will allow data to be read, and therefore the inaccuracy of the data of column 5 has no effect on the final accuracy of the work.

29. In Test No. 1, the data of which are given in Table 1, practically no lubrication was used, the gears having been washed off with gasoline. Previous to this there had been oil and graphite on the gears and some of the graphite still remained on the teeth. However, after running for a while they were practically non-lubricated. The 3-lb. rider had to be used in this case because of the amount of the friction loss, which, by the way, was sufficient to cause the gears to heat considerably.

30. Table 1 gives only a few of the results actually obtained, for the apparatus was started time after time and the balance by the rider gave the same results over and over again.

31. The next test was made to see how much the efficiency would be increased with good lubrication. Accordingly some heavy oil and flaked graphite were mixed and used as a lubricant. The efficiency was so much increased that the 1½-lb. rider weight was sufficient, and again it was found that the same results were obtained time after time. The recorded data appear in Table 2.

32. Later, after the graphite and oil had become more perfectly blended, another test was made, the recorded data for which are given in Table 3.

33. The efficiency curves for these three tests are all given in Fig. 4. The difference between the results of non-lubricated and lubricated conditions is perfectly clear. The test with the more perfect blending of the lubricant showed results identical with the previous one except as indicated by the dash line at the end of the upper curve. This showed that the lubricant was not squeezed out from between the teeth at quite so low a pressure.

34. The form of the curves and the consistency of the readings convinced the experimenters that very reliable results had been obtained.

Efficiency of Worm-Gear Drive

35. Data of Gear, Worm and Apparatus. The gear was made of phosphor bronze with 40 teeth; pitch diameter, 10.5704 in.; throat diameter, 10.9964 in.; circular pitch, 0.8302 in.; angle of teeth with axis, 38° 16′ 5″; normal circular pitch, 0.6518 in.; thickness of tooth, 0.3568 in.

36. The worm was made of Aurora steel, case-hardened, and had 9 teeth; pitch diameter, 3.015 in.; outside diameter, 3.441 in.; circular pitch, 1.0524 in.; angle of teeth with axis, 51° 43′ 55″; thickness of tooth, 0.295 in.; lead, 7.4719 in.

37. This drive was made by the Brown & Sharpe Mfg. Co., and mounted by them in a ball-bearing case especially designed for the purpose of testing. The set-up of the apparatus was the same as for the bevel-gear tests (see Fig. 2), except that the positions of the knife edges on the lever were changed to agree with the new gear ratio, giving the following dimensions:

Number of teeth in gear 40
Number of teeth in worm 9
Ratio, 40÷9 .... 4.444
Total length of lever between outside knife edges .... 3.645 ft.
Length of long arm of lever .... 2.9755 ft.=35.72 in.
Length of short arm of lever .... 0.6695 ft=8.04 in.
Length of dynamometer arms .... 31.5 in.

38. Calculation of Horsepower Loss from Movement of Rider. The calculation for horsepower loss in this case is

TABLE 3 DATA OF EFFICIENCY TEST OF BEVEL-GEAR DRIVE

HEAVY OIL AND GRAPHITE LUBRICATION. GRAPHITE AND OIL BLENDED BETTER THAN IN TEST OF TABLE 2

R.p.m. of motor	Scale pan, lb.	P_3 lb.	$0.2122 P_3$	x ft.	$0.379x$	P_1	Input, hp_{1000}	Input, actual hp.	Rider hp_{1000}	Hp. loss	Output, hp.	Eff'y per cent
1122	5	200	42.44	1.16	0.417	42.857	21.428	24.09	0.27	0.303	23.787	98.7
1124	5	200	42.44	1.16	0.417	42.857	21.428	24.09	0.27	0.303	23.787	98.7
1143	4	160	33.95	0.80	0.303	34.253	17.126	19.58	0.19	0.217	19.363	98.8
1141	4	160	33.95	0.80	0.303	34.253	17.126	19.58	0.185	0.212	19.368	98.8
1162	3	120	25.46	0.58	0.220	25.680	12.840	14.91	0.14	0.163	14.747	99.0
1177	2	80	16.97	0.50	0.189	12.159	8.579	10.08	0.12	0.141	9.939	98.4
1195	1	40	8.49	0.50	0.189	8.679	4.339	5.19	0.12	0.143	5.057	97.4
1200	½	20	4.246	0.50	0.189	4.434	2.217	2.67	0.12	0.144	2.526	94.6

the same as for the bevel-gear test except for the change in length of the lever arm and the weight of the rider. In this test a 6-lb. rider was used and the equation is as follows:

$$6x = 2 \times 35.72$$

from which

$$x = 11.91$$

therefore a movement of 11.91 in. of the rider is equivalent to 1 hp_{1200} for a 6-lb. rider. A paper scale laid out according to these figures was used throughout this test.

39. Calculation for Horsepower Input. The equations are of the same form as those for the bevel-gear test and the figures are as follows:

$$0.6695P_2 - 3.645P_1 - Wx = 0$$

and for W=6,

$$P_1 = 0.1837P_2 - 1.647x$$

x being the displacement of W measured in feet.

40. Considerable trouble was experienced at first in getting the initial balance of the apparatus as it was not at all sensitive. However, it was soon found that the weight of the Alden dynamometer caused a deflection of the shaft and consequently friction on the oil-retaining ring of the gear case, which had a very small clearance. When the weight of the dynamometer was taken from the shaft by means of a cord passed around the hub and an equalizing bar above, to

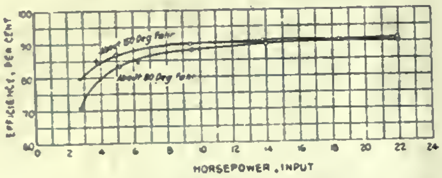


FIG. 4—HORSEPOWER-EFFICIENCY CURVES OF WORM GEAR DRIVE

Results at two different temperatures of lubricating bath. Ratio 40 to 9; rev. per min. of worm about 1,200.

which the ends of the cord were attached, the apparatus became sensitive at once. The purpose of the equalizing bar was to lift the weight without introducing any moment for slight movements of the dynamometer casing.

41. This apparatus ran without anywhere near as much vibration as the bevel-gear apparatus and it was accordingly easier to handle.

42. A heavy oil sold by the Texas company under the name of Thuban oil was used for lubrication. The power loss in these gears was so large, however, that the temperature of the oil bath increased very rapidly. No tests were run to determine the limit of this rise or rate of increase, but tests were made at certain selected temperatures. Data of these tests are given in Table 4.

43. By testing at constant temperature the effect of the change in viscosity of the oil on the action of the lever was eliminated, but the effect on the efficiency is clearly shown by the curves in Fig. 4.

44. It is of course obvious that no test could actually be made at constant temperature, and the tests were really made by keeping the load constant and noting the loss as the temperature went up. These readings were recorded, however, as if the tests had been constant-temperature tests.

45. It is interesting to note in Fig. 4 that at the lowed temperature, when the oil was viscous, the efficiency at light load was quite low, while at the higher temperature the efficiency increased, as one would expect, on account of its taking less power to churn up the thinner oil. But at the other end of the curves, that is, the high-power end, the reverse condition is found, indicating the inability of the oil to maintain proper lubrication at high tooth pressures when it becomes thin.

46. Again the form of the curves and the consistency of the data obtained point to the reliability of the apparatus.

47. It is accordingly concluded that this apparatus will measure accurately the efficiency of any positive shaft drive where both shafts are rotating at constant speed, and that it seems to be the best method yet devised for testing gear drives for efficiency, since it measures directly the actual power loss.

48. While this paper has described only tests of bevel-and worm-gear drives, tests of other drives have been made, and the method is applicable to all types.

TABLE 4 DATA OF EFFICIENCY TEST OF WORM-GEAR DRIVE

TEXAS CO'S. THUBAN OIL LUBRICATION

R.p.m. of motor	Scale pan, lb.	P_2 lb.	$0.1837 P_2$	x ft.	$1.647x$	P_1	Input, hp_{1200}	Input, actual hp.	Rider hp_{1200}	Hp. loss	Output, hp.	Eff'y, per cent	Temp., deg. fahr.
1109	5	200	36.73	1.72	2.83	39 56	19.78	21 96	1.65	1 93	20 03	91 3	80
1109	5	200	36.73	1.88	3 09	39 82	19.91	22.10	1.90	2 11	19.99	90.5	150
1137	4	160	29.38	1.42	2.34	31 72	15.86	18.03	1 44	1 635	16.395	90 7	80
1137	4	160	29.38	1 48	2.44	31 82	15.91	18 10	1.50	1 706	16.394	90.6	150
1156	3	120	22.03	1.23	2.03	24.06	12.03	13.91	1.24	1 435	12.475	89.7	80
1156	3	120	22.03	1.10	1.81	23.84	11.92	13.75	1 10	1.270	12.480	90.8	150
1175	2	80	14.69	0.92	1.515	16.205	8.102	9.52	0.94	1.105	8.413	88.3	80
1175	2	80	14.69	0.82	1.35	16.04	8.02	9.42	0.82	0 964	8.456	89.9	150
1193	1	40	7.345	0.70	1.15	8.46	4.23	5.05	0.70	0.835	4.215	83.5	80
1193	1	40	7.345	0.53	0.872	8.217	4 11	4 90	0.54	0.645	4.255	86.8	150
1200	½	20	3.673	0.68	1 12	4.793	2.39	2.76	0.68	0.807	1.953	70.7	80
1200	½	20	3.673	0.45	0 740	4.413	2.20	2.65	0.46	0 554	2.096	79.1	150

TESTING GUNS FOR AIRCRAFT

The Browning machine gun has successfully undergone a test to determine its value for use with aircraft. This is one of three types of machine guns with which the rate of fire can be so synchronized with the revolutions of the propeller of a tractor airplane that the gun can be fired by the pilot of a combat plane through the revolving blades. Firing in that fashion, it is necessary to aim the machine gun by steering the plane directly at the target. The direction of the plane gives direction to the fire and the pilot can fire the machine gun while controlling the plane.

Connected With Engine

Airplane propellers revolve at from 800 to 2,000 revolutions per minute. The machine gun is connected with the air plane engine by a mechanical or hydraulic device, and impulses from the crank shaft are transmitted to the machine gun. The rate of fire of the machine gun is constant and its fire is synchronized with the revolving propeller blades by "wasting" a certain percentage of the impulses it receives from the airplane engine and by having the remaining impulses trip or pull the trigger so that the gun fires just at the fraction of the second when the propeller blades are clear of the line of fire.

The pilot operates the gun by means of a lever which controls the circuit and allows the impulses to trip the trigger.

Severe Test Given Gun

The test given the Browning gun was severe. A gun was mounted on the frame of an American combat plane and connected with the airplane engine. The test was conducted on the ground and in place of the propeller a metal disk was attached to the crank shaft. The Browning gun was then required to register hits on the metal disk as it revolved at varying speeds from 400 to 2,000 revolutions per minute. The slightest "hang fire" or delay in action on the part of the gun would have been shown by the failure of the bullets to hit precisely on the spot on the disk representing the centre of the zone of fire. The gun functioned perfectly.

The Browning gun to be used with aircraft is the heavy type with the water jacket removed.

Will Also Use Marlin Gun

Besides the Browning, the United States will also employ the Marlin aircraft gun as a synchronized weapon. Several thousand of these have been manufactured and the gun is in quantity production.

The British and French use the Vickers as a synchronized machine gun.

The Lewis aircraft machine gun is used by the British, French, and American forces, but for a different purpose. In a two-seated combat plane, fixed machine guns are mounted forward to be operated by the pilot and flexible guns are mounted to be operated by the observer in the rear seat of the plane. The observer operates Lewis guns on flexible mounts, firing to right or left of the plane.

It is of vital importance to have absolute reliability of function in a synchronized machine gun on tractor airplanes.

Producing Special Steel to Suit Specific Purposes

New Strip Mill at Massillon, Ohio, Adapts Steel to Methods and Machines—Produces Rolled Strips With Wide Range of Uses in Standard and Alloy Steels—Designed to Eliminate Manufacturers' Troubles

FOR years it has been to a great extent customary and quite necessary for manufacturers of machines and parts to consider what material wat available in the market and then adapt their work and product to that condition. This has sometimes placed them at great disadvantage and has been a check to extensive improvements and development.

Within the last few years the use of alloys in steel making has passed beyond the experimental stag into standard use and practice. It has been the means of establishing new industries and developing new machinery and new method. In one product the evolution has promoted a plant totally different to any heretofore devised. It is the installation at Massillon, Ohio, of the plant of the National Pressed Steel Company, which was specially designed and built for rolling strips by an improved method and practice for a wider range of uses in standard and alloy steels.

Organized Effort

Realizing the needs of the situation a group of young men familiar with the difficulties incident to the deep drawing, stamping, forming and pressing of steel products, and also the need for new and better qualities, set out to build a mill to meet the demands. Their aim was to produce a wider range of sizes and the proper quality and physical characteristics in hot and cold rolled strips especially adapted to this particular class of work.

Representative lots of steel intended for stamping and similar purposes were carefully examined by microscope analysis and other methods, all of which indicated the fact that while in the past research work had been carried on to improve the composition of steels in general, and that while some attention had been given to scale elimination, etc., very little thought had been given to the subject of mechanical treatment. This investigation and careful research convinced the designers that new methods and practice were necessary.

All the information and data obtained pointed to the necessity for a departure from standard machinery, methods and practice. Before designing the machinery, equipment and plant, which for the new purposes required many innovations in heating and rolling, it was considered necessary to consult the trade purchasing and using this class of steel in order to obtain complete data and authentic information.

Survey of Requirements

An abstract was accordingly prepared containing thirty-seven questions, each one important to the establishment of the new methods thought necessary, and so prepared as to require little time and effort in giving the answers. This was sent to a large number of manufacturers producing pressed and drawn steel specialties, and brought forth immediate and enthusiastic response. The returns reached forty-seven per cent., which answered in whole or in part the entire abstract.

With the complete data and reliable information then at hand bearing on size, finish, analysis, quality, physical characteristics, the design of this unusual plant was undertaken by the company's own men, carefully adhering to basic principles. In spite of adverse conditions in material and machinery markets, weather, etc., in ten months and one day from the time ground was broken the plant was in operation.

This plant with its special equipment, new methods and practice is now producing a material of such physical property and quality that without any annealing it can be used in a great many cases where formerly annealed strips were considered a necessity.

Inspection of Raw Material

Raw material is received in the form of slabs and billets and is unloaded from the cars by means of cranes carrying rectangular lifting magnets.

Fig. 1 is a view of the charging end of No. 1 Heating Furnace together with the Electric Overhead Travelling Crane serving it. The slabs are picked up by this Crane by means of a magnet and placed on the skids in front of the Massive Pushers. These machines are of unusually heavy design and are electrically controlled and operated. As hot slabs are drawn for rolling, cold ones are pushed into the furnace at the rear or charging end. Fig. 2 shows a partial end and side view of the No. 1 Heating Furnace with a portion of the Mill Approach Table, Roller Table and of the delivery end of the Slab Transfer in the foreground. Above the top of the furnace may be seen the pipes through which is conveyed the air and powdered coal, by means of which the furnace is heated.

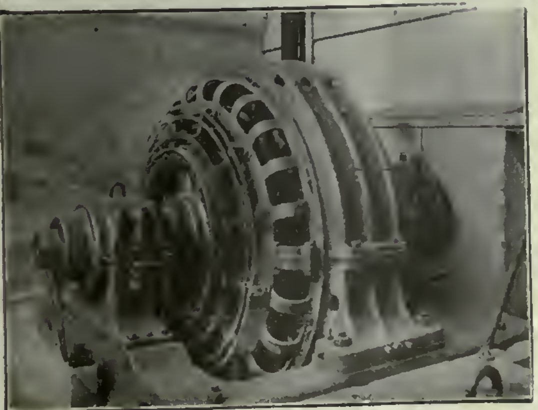


Fig. 3 is a view of the Westinghouse Reversing Mill Motor, which was designed and built especially for this installation. To one watching it in operation, it causes an almost uncanny feeling. Its silent and almost instant reversal from full speed in one direction to full speed in the opposite direction, giving no indication of the tremendous power being developed. This motor derives its power from a Motor Generator Set, which is shown in Fig. 4. To enable it to carry peak loads it is provided with a solid steel plate fly wheel. This form of construction is necessary in order to withstand the terrific stresses produced by reason of its high speed revolution—the rim of this fly wheel travelling more than four miles per minute.

Before any material is placed in stock or used, each piece is carefully inspected for seams, pipes, or any other defects which could be rolled into the steel by later manipulation and not detected until the material was in the customer's presses. The stockyard has a capacity of from fifteen

Fig. 5—This shows a view looking down through the mill from a point near the 24 in. Universal Mill Rollers Pulpit.

to twenty thousand tons of steel and adjoins the mill building.

Great care and attention were given to the design and detail for the furnaces to insure uniform heating. They are of the large continuous reheating type, using powdered coal as fuel. All parts and accessories were specially designed and constructed for this method of heating. Pushers, drawing machinery, door hoists, transfer tables and all equipment auxiliary to the furnaces are electrically operated. The steel is transferred to the roughing mill in a unique manner, and in such a way that practically all furnace scale is removed.

Roughing Mill

The roughing mill is a high-speed 24-inch two high universal mill and is driven by a Westinghouse reversing motor similar to those used in blooming mills but smaller and much faster. An idea of the extreme proportions of the mill will be conveyed by the statement that the housings weigh approximately 42 tons each, and that all other parts are correspondingly heavy. When it is borne in mind that this company produces large quantities of special alloy steels in the form of strips up to No. 00 gauge x 24 inches wide, the necessity for such heavy units will be appreciated. The extreme rigidity of the mill and foundations are also realized upon considering that when finishing 50 carbon steel less than one-thousandth of an inch (.001) is allowed for spring of the mill. The vertical rolls on this mill are designed and operated so that proper side work may be given the steel. This method of rolling also holds the width dimension to slight variation.

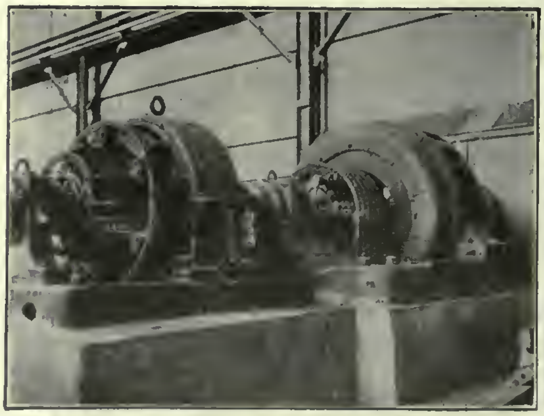
If the material is brought to gauge on the roughing mill, the strip is turned over after rolling in order to facilitate inspection and remove any slight remaining scale. It is then transferred to a leveller or straightener of extremely rugged construction. From this the product is delivered to the hot bed.

Finishing Light Material

When producing lighter material only the roughing operations are used on the roughing mill, as a train of finishing mills has been provided for the final passes. These mills are operated entirely by mechanical means—no manual labor being required. Driving power is furnished by a Westinghouse motor of the Kramer type, permitting a wide range of operating speeds with good electrical efficiencies.

From these mills the material is delivered to hot bed or coiler as may be required. On leaving the hot bed the strips are cut to length and piled by a mechanical piler, placed in stock if they are to be shipped as plain hot rolled material, or transferred to the finishing department if additional treatment is required.

In addition to the usual slitting, shearing, oiling and liming machinery, the finishing department has extensive facilities for heat treating and pickling. Each furnace has a charging capacity of approximately twenty-five tons and also the necessary mechanical means for reading and heat control, assuring uniform heat treatment. The furnace men can observe and control the furnace temperature at all times, but the recording instruments and the records are seen only by the department superintendent, who thus has a definite and accurate record of all conditions and every operation employed on past work. The pickling vats are of the plunger type in standard details, but of large size for pickling large pieces whether flat or coiled.



In Fig. 6 are shown the Transfer Tables serving the 16 in. Finishing Mill. The Westinghouse Motor used for driving this Mill is shown in Fig. 7. As in the case of the motors driving the Universal Mill this motor was also designed especially to meet the requirements of this particular installation.

The steam for heating pickle liquors and other miscellaneous heating processes is generated by a boiler placed over the annealing furnace flues.

Research Department

The research department continues further investigation through their physical and chemical testing laboratories. These laboratories provide to the inspection department all tests needed to insure thorough knowledge of materials produced, the extent of tests being dependent upon character, quality and ultimate use of material on order.

The plant has a number of unusual and interesting features.

(a) Electricity used for power throughout.

(b) Practical elimination of hard physical and hand labor which formerly has been the rule.

(c) Large clean, well lighted and well ventilated buildings.

(d) Extensive methods and extra care to eliminate scale.

(e) Unusual, heavy equipment to bring size variation to a minimum.

(f) Unusual rolling methods to produce steels and alloys in steel of superior quality and new characteristics.

Experiments, investigation and research as continued by this organization will doubtless develop further data and information to enable production of materials with other new qualities and characteristics, and thus the field for specialties manufactured from such source of supply will be extensively broadened and developed.

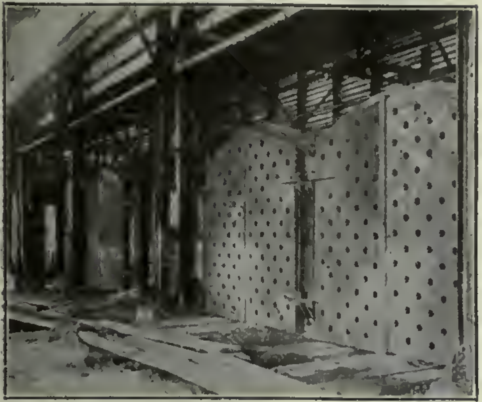
HOW WORKMEN TEST STEEL

The Steel Treating Research Society of Detroit have done good work in recent months in directing attention to the discussion of vital steel problems. At a recent meeting they were addressed by John F. Keller of Purdue University, Ind., who made some interesting statements regarding the methods by which workmen test various steels.

Some Common Methods

Among the various ways of judging the quality of steel, the most common are: trade or quality stencil marks, labels pasted on the bars, bars painted different colors, general shape of the material, appearance of surface, heft or weight, ring or tone of metal when dropped, feeling, intuition, smell, fracture test, fire and water test, service test, and spark test.

The first two are the most dependable methods, except that if the steel is kept in a damp place the labels will drop off in the course of time due to rust. The third method is dependable if a general scheme of colors is used for the different brands of steel and the system is intelligently applied. There is, however, in many factories extreme carelessness and indifference in the painting of valuable stock; in one factory seven grades of stetel were painted one color.



In Fig. 8 several of these furnaces are shown, while in Fig. 9 is shown a corner of the Pickling Department.

Shape

Many workmen select steel by its general shape; for instance, a hexagon section will represent screw stock and an octagon section will indicate cold chisel steel. But this method of selecting should not be tolerated, because steel can be manufactured into any form or shape desired, except stellite, which is cast into form. It may surprise some engineers to learn that many tool steels are selected by the appearance of the surface. If the bars are smooth and have sharp corners, it is evidence to the workmen of first-class steel. Without other evidence, expensive labor is put upon the tool and usually only when hardening is the mistake discovered. Smooth surfaces and sharp corners indicate work at low temperatures, while rough surfaces and round corners are caused by an iron ovide scale when the metal is laid down at high temperature; therefore, the appearance of the surface does not indicate the quality or composition of the metal.

Tone

Many workmen, not satisfied by the shape, appearance and weight, drop the metal on a hard floor or a heavy piece of iron; if the ring is a sharp tone, the metal is thought to be a good quality of steel. The finer the grain the more homogeneous the structure, and the harder the metal, the sharper is the tone. These qualities are developed by elements in the metal by working, and by heat-treating at a moderately low temperature. On the other hand, wrought iron will emit a dull tone owing to the presence of about 2 per cent. of slag and the usual methods of working such metal at a high temperature. This method is not reliable or dependable, because work and heat-treatment will affect the tones emitted when the material is struck or dropped.

It is surprising how many expert toolmen will select material by intuition; and because of their opinion they work the tool into shape regardless of any indication in its cutting properties that the metal may be undesirable. Their mistake is usually discovered when attempting to harden the metal or when putting it into service. It is said that in the southern part of the state a man nicks a bar of stock with a cold chisel, breaks it in two, and immediately smells the fracture, claiming that a good quality of steel smells like ammonia. There is no ammonia in steel. Many of the tests used by workmen are just as reliable.

Fracture

The fracture test does not represent the true quality of metal, but rather indicates the last heating operation to which the metal was subjected. A fracture that has a coarse granular appearance may not mean that the material is of inferior quality, but that it was laid down at high heat and the crystals retained the size corresponding to that heat. There are exceptions to this rule, however, for many of the elements in alloy stetels prevent or retard crystallization at high temperature. High-speed steel shows an unusually fine grain after being heated to 2,250° F.; on the other hand, carbon tool steel heated to its critical temperature and immediately quenched shows a fine silky structure, and it is doubtful if the average mechanic is able to distinguish these metals when they are placed together for comparison. If a small piece of carbon tool steel is heated to just above its critical temperature, about 1,450° F., known as a dark cherry red, and immediately quenched in water, it will be hard enough to resist a sharp file; and when fractured it should show a fine silky structure. If low or inferior grade of carbon steel is treated in this manner the surface may be hard enough to resist a file but the fracture will not show a fine structure.

Haphazard

Many workmen as well as the experimental engineer select available material at hand without any determination as to quality, and then put expensive labor upon the part or tool. When finished, it will be tried out in service, and if it fails, something else is tried. Such failures are usually found in the scrap heap. The service test, however, has its advantages if the engineer has a knowledge of the material so tested. This information is invaluable as it is the combination of successes and failures that gives the empirical knowledge that completes the perfect understanding of theory. A record of the life work of a piece of steel and accurate data are the most powerful tools that an engineer has. Therefore, the scrap heap of failures is the most instructive place about a plant.

The spark method is based on the action of the oxygen of the air on the combustible element present in iron and in many of the alloying elements contained in the different steels, which act explosively when heated to a temperature necessary for combustion. To produce bright sparks as the result of heating finely divided particles of metal, the heat must be intense enough to cause chemical combustion between the oxygen of the air and the particles of metal.

ENGINEERS WANT SPECIAL INSTRUCTION FOR WOMEN STUDENTS

At a recent joint session of the Detroit section of the American Society of Mechanical Engineers and the Detroit Engineering Society, the following motion was passed:

"WHEREAS the demands of the country for men and means to fight the war has resulted in a deficiency of skilled workers in the trades and professions; and

"WHEREAS the women of this country could with a short period of training fit themselves to fill these positions, as women have done in other countries at war; and

"WHEREAS among the things which women could do advantageously are, drafting and tracing, inspection and testing of materials, both physically and chemically; therefore

"RESOLVED that the universities, colleges and technical schools throughout the land be asked to consider the question of meeting this demand by providing special courses of instruction open to women students qualified to pursue such courses, and further

"RESOLVED that employers who could use such skilled help exert their influence with their universities, colleges and technical schools, and co-operate with them in developing and making available a great body of intelligent and adaptable women who are as eager and willing to serve their country as their brothers;

THEREBY bringing about not only increased effectiveness in fighting the war but also a greater mutual respect and saner relationship of our men and women."

Reconstruction Receives Organized Attention from the British Government

Eighty-seven Bodies in Fifteen Groups Cover the Field of Effort—Problems of the Future Are Being Foreseen When Possible and Every Preparation Made For Their Solution

THE manner in which the British nation has organized itself to meet each succeeding problem of the ar has been one of the most surprising atures of the times. The improbability at the world will be dominated by the ın has led to attention being given to timate conditions, and the question of w to prepare for them has resulted in eation in Britain of the Ministry of econstruction which has appointed rious commissions and committees to al with prospective problems.

The various matters dealt with cover ery phase of activity from trade de-elopment to the treatment of aliens—om coal and power to labor and em-oyment. The eighty-seven bodies are ranged in fifteen groups as follow, hile a summary of their constitution ıd scope is appended, the parentheses dicating the department which directs e particular committee.

I. Trade development, under which rouping are five committees dealing ith general aspects and nine dealing ith specific phases of the situation.

II. Finance, with two committees.

III. Raw materials, with six commit-ees.

IV. Coal and power, with two commit-ees and four sub-committees.

V. Intelligence, with two committees.

VI. Scientific and industrial research, ith two research boards, five standing ommittees, seven research committees, our inquiry committees, and three pro-isional organization committees.

VII. Demobilization and disposal of tores, with eight committees.

VIII. Labor and employment, with two ommittees.

IX. Agriculture and Forestry, with our committees.

X. Public Administration, with six ommittees.

XI. Housing, with four committees.

XII. Education, with eight commit-ees and commissions.

XIII. Aliens, with two committees.

XIV. Legal, with three committees.

XV. Miscellaneous, with three commit-ees.

An idea of the many matters which it s believed will require careful consider-ition upon the cessation of hostilities nay be gained from a summary of these commissions and committees; directed in each case by the department indicated in parentheses after the name of the com-mittee.

The Development of Trade

Commercial and Industrial Policy Committee (the Prime Minister).—To consider the commercial and industrial policy to be adopted after the war, with special reference to the conclusions reached at the economic conference of the Allies and to the following questions: (a) What industries are essential to the future safety of the nation, and what steps should be taken to maintain or establish them? (b) What steps should be taken to recover home and foreign trade lost during the war and to secure new markets? (c) To what extent and by what means the resources of the em-pire should and can be developed? (d) To what extent and by what means the sources of supply within the empire can be prevented from falling under foreign control?

Dominions Royal Commission.—To in-quire and report upon (a) the natural resources of the five self-governing do-minions and the best means of develop-ing these resources; (b) the trade of these parts of the empire with the United Kingdom, each other and the rest of the world; (c) their requirements and those of the United Kingdom in the mat-ter of food and raw materials, together with the available sources of supply; (d) to make recommendations and sug-gest methods consistent with existing fiscal policy by which the trade of each of the self-governing dominions with the others and with the United Kingdom could be improved and extended.

The Development of Industries

Industrial Development Commission (Government of India).—To examine and report upon the possibilities of further industrial development in India and to submit its recommendations with special reference to the following questions: (a) Whether new openings for the pro-fitable employment of Indian capital in commerce and industry can be indicated; (b) whether, and if so, in what manner, the government can usefully give direct encouragement to industrial development (1) by rendering technical advice more freely available, (2) by the demonstra-tion of the practical possibility on a commercial scale of particular industries, (3) by affording, directly or indirectly, financial assistance to industrial enter-prises, or (4) by any other means which are not incompatible with the existing fiscal policy of the government of India.

Belgian Trade Committee (Foreign Office and Board of Trade).—(1) To in-quire into all matters relative to trade between the British Empire and Belgium with a view to increasing and developing that trade by every desirable means; (2) to investigate as far as possible all means to be adopted in order to attain the object set out in par. 1. The com-mittee will examine into the supplies and requirements of the respective countries (in so far as they have relation to its scope) and give advice as to how trade between them can be best established, developed and increased. It will obtain information and evidence from all avail-able sources and endeavor to render all possible assistance in regard to shipping, manufactures, imports and exports, and trade generally between the empire and kingdom; (3) the committee will consist of three representatives appointed by the Foreign Office and three representa-tives appointed by the Board of Trade. A chairman and secretary will be chosen from their number. The committee shall have power to add to its numbers by the appointment of such persons of ex-perience in the matters with which it has to deal as it may think expedient, and it will also consult from time to time other representatives of commerce hav-ing special knowledge of Belgian trade, shipping and finance; (4) it is particu-larly laid down that the purpose of this committee shall be a general one and that it shall not be part of its duties to foster the advancememnt of the trade of any particular individual or firm nor to devote its assistance to any special branch of trade or industry except in re-lation to the general principles for which it is established.

Trade Relations After the War Com-mittee (Board of Trade).—To investi-gate the general questions of trade re-lations after the war with a view to the successful promotion of British trade, and also with the object of devising measures for the prevention of the ef-fective resumption of Germany's policy of peaceful penetration.

Committee on the Chemical Trades (Ministry of Reconstruction).—To advise as to the procedure which should be adopted for dealing with the position of th chemical trade after the war, with a view to the creation of some organiza-tion which should be adequately repre-sentative of the trade as a whole and by means of which the trade may be enabled hereafter to continue to develop its own resources and to enlist the closest co-operation of all those engaged in the chemical industry.

The Engineering Trades

Engineering Trades (New Industries) Committee (Ministry of Reconstruction). —To compile a list of the articles suit-able for manufacture by those with engineering-trade experience or plant, which were either not made in the United Kingdom before the war, but were im-ported, or were made in the United Kingdom in small or insufficient quantities, and for which there is likely to be a considerable demand after the war, classified as to whether they are capable of being made by (1) women, (2) men and women, or (3) skilled men; and setting out the industries to which such new manufactures would most suitably be attached; and to make recommendations (a) on the establishment and development of such industries by the transfer of labor, machines, and otherwise; (b) as to how such a transfer could be made, and what organization would be requisite for the purpose, with due regard to securing the co-operation of labor.

Board of Trade Committees on the Coal, Electrical, Engineering, Iron and Steel, Nonferrous-Metal and Textile Trades, and on the Shipping and Shipbuilding Industries.—To consider the position of these trades and industries after the war, with special reference to international competition, and to report what measures, if any, are necessary or desirable to safeguard that position.

Financial Facilities Board

Financial Facilities Committee (Treasury and Ministry of Reconstruction).—To consider and report whether the normal arrangements for the provision of financial facilities for trade by means of existing banking and other financial institutions will be adequate to meet the needs of British industry during the period immediately following the termination of the war, and, if not, by what emergency arrangements they should be supplemented, regard being had in particular to the special assistance which may be necessary (a) to facilitate the conversion of works and factories now engaged upon war work to normal production; (b) to meet the exceptional demands for raw materials arising from the depletion of stocks.

Enemy Debts Committee (Foreign Office).—To report on the arrangements to be adopted for the liquidation of the commercial, banking and other financial transactions between British and enemy persons, the completion of which was prevented by the outbreak of war, and for this purpose to consider the returns made to the custodians of enemy property, and to the public trustee and the foreign claims office, and any information on matters relating thereto.

Committees on Raw Materials

Central Committee on Materials Supply (Ministry of Reconstruction).—To consider and report upon (1) the nature and amount of the supplies of materials and foodstuffs which in the committee's opinion will be required by the United Kingdom during the period which will elapse between the termination of the war and the restoration of a normal condition of trade; (2) the probalbe requirements of India, the dominions and crown colonies for such supplies at the close of hostilities; (3) the probable requirements of belligerents and neutrals for such supplies at the close of hostilities; (4) the sources from which and the conditions under which such supplies can be obtained and transported and in particular the extent to which they might be obtained from the United Kingdom or within the empire or from allied or neutral countries; (5) the question whether any measure of control will require to be exercised in regard to the nature and extent of any such control.

Building Materials Supply

Committee on the Supply of Building Materials (Ministry of Reconstruction). —(1) To inquire into the extent of the probable demand for building material for all purposes which will arise in the country during the transition period and the extent of the available supply and form of such material; (2) to inquire how far the quantities of material now available are capable of increase, what are the difficulties in increasing them, and how these difficulties can be removed, and to report to what extent an increase in production will affect the price of the materials; (3) in the event of the supply of material or labor being insufficient to fulfill the total building demand, to consider the principles and method by which the priority of various claims should be settled, and to report what steps are necessary to insure that the manufacture of the materials, so far as they are at present inadequate, shall be extended in time to secure sufficient quantities for use when required on the cessation of hostilities and to recommend what steps should be taken during the war to facilitate a prompt commencement of building work at that time; (4) generally to consider and report upon any conditions affecting the building trades which tend to cause unduly high prices and to make recommendations in regard to any measure of control which it may be desirable to exercise over the purchase, production, transport or distribution of materials.

Cotton at Home and Abroad

Committee on Cotton Growing Within the Empire (Board of Trade).—To investigate the best means of developing the growing of cotton within the empire and to advise the government as to the necessary measures to be taken for this purpose.

Coal Conservation Committee (Ministry of Reconstruction).—To consider and advise (1) what improvements can be effected in the present methods of mining coal with a view to prevent loss of coal in working and to minimize cost of production; (2) what improvements can be effected in the present methods of using coal for production of power, light and heat, and of recovering by-products with the view to insure the greatest possible economy in production and the most advantageous use of the coal substance; (3) whether, with a view to maintaining industrial and commercial position, it is desirable that any steps should be taken in the near future, and if so, what steps to secure the development of new coal fields or extensions of coal fileds already being worked.

Mining, Power Generation and Transmission, Carbonization and Geological Subcommittees.—The question of the application of carbonization to the preparation of fuel for industrial and commercial purposes.

Committee on Supply of Electricity (Board of Trade).—To consider and report what steps should be taken whether by legislation or otherwise, to insure that there be an adequate and economical supply of electric power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their development.

Scientific and Industrial Research

The following 21 committees have been established by the department of scientific and industrial research:

Fuel Research Board.—To investigate the nature, preparation and utilization of fuel of all kinds, both in the laboratory and, where necessary, on an industrial scale.

Cold Storage Research Board.—Appointed to organize and control research into problems of the preservation of food products by cold storage and otherwise.

Standing Committees on Engineering, Metallurgy, Mining and Glass and Optical Instruments.—To advise the council on researches relating to the lines of activity named and on such matters as may be referred to the committee by the advisory council.

Joint Standing Committee on Illunminating Engineering.—To survey the field for research on illumination and illuminating engineering, and to advise as to the drections in which research can be undertaken with advantage.

Mine Rescue Apparatus Research Committee.—To inquire into the types of breathing apparatus used in coal mines, and by experiment to determine the advantages, limitations and defects of the several types of apparatus, what improvements in them are possible and whether it is advisable that the types used in mines should be standardized, and to collect evidence bearing on these points.

Abrasives and Polishing Powders Research Committee.—(1) To conduct investigations on abrasives and polishing powders with a view to their preparation and use as one factor in accelerating the output of lenses and prisms for optical instruments not only for peace requirements but in connection with the war; (2) to investigate the preparation and properties of abrasives and polishing powders.

Food Research Committee.—To direct research on problems in the cooking of vegetables and meat, and in bread making, to be undertaken by two scholars of the committee of council.

Building Material Research Committee. —To make arrangements for carrying out researches on building construction instituted by the department at the instance of the Local Government Board Committee or otherwise, to be responsible under the council for the direction of such researches, and to deal with such other matters as may be referred to the committee from time to time by the council.

Electrical Research Committee.—A committee of direction appointed in connection with certain researches affecting the electrical industry.

Committee for Research on Vitreous Compounds and Cements for Lenses and Prisms.—To conduct researches into the preparation, properties and mode of employment of cements for lenses and prisms; to prepare a reference list of vitreous compounds, their composition, densities, refractive indices and dispersive powers.

Tin and Tungsten Research Board. — The Cornish Chamber of Mines has been invited to nominate a representative of the landlords and a representative of the mine owners to serve on the board. A committee of control appointed in connection with certain researches into tin and tungsten.

Lubricants and Lubrication

Lubricants and Lubrication Inquiry Committee.—To prepare a memorandum on the field for research on lubricants and lubrication, which will contain an analysis of the problems involved, together with a suggested scheme of research, which would be most likely to lead to valuable results.

Chemistry of Lubricants Subcommittee. —To collect and review the existing information relating to the chemistry of lubricants and lubricating oils.

Zinc and Copper Research and Inquiry Committee.—To collect and review the existing information as to the copper and zinc industries upon which future research must be based, to formulate proposals for carrying out research suggested by the Brass and Copper Tube Association of Great Britain into the best methods of making sound castings of copper and brass for tube making and to prepare an estimate of their cost, and to report to the advisory council.

Irish Peat Inquiry Committee.—To inquire into and consider the experience already gained in Ireland in respect of the winning, preparation and use of peat for fuel and for other purposes, and to suggest what means shall be taken to ascertain the conditions under which in the most favorably situated localities it can be profitably won, prepared and used, having regard to the economic conditions of Ireland; and to report to the Fuel Research Board.

Demobilization and Disposal of Stores

Demobilization of the Army Committee.—To consider and report upon the arrangements for the return to civil employment of officers and men serving in the land forces of the crown at the end of the war.

Officers' Resettlement Subcommittee.— To consider and report what arrangements require to be and can be made on demobilization for resettlement of officers in civil life, and also of men belonging to classes to which in the main officers belong.

Disabled Officers' Employment Committee (India and Colonial Offices).—To assist disabled or invalided officers who may be desirous of obtaining employment in India, Burma, the Eastern colonies and Malay States.

War Office Demobilization Committee. —To consider questions requiring settlement in connection with the demobilization of the army in so far as they fall within the province of the war department; to act as a link with the committee of the Ministry of Reconstruction, and to prepare a draft scheme of demobilization.

Demobilization Coordination Committee (Admiralty, War Office and Ministry of Labor).—(1) To consider how far the proposed special arrangements to demobilize immediately peace is declared men specially required in connection with the work of demobilization can or should be extended to other men belonging to the public services or to similar "pivotal" men in industry; (2) to coordinate the working of the demobilization scheme of the war department with the resettlement scheme of the ministry of labor; (3) to settle, during demobilization, instructions with regard to priority which may appear to be rendered necessary on public grounds or by the sort of employment in the different industries.

Civil War Workers

Civil War Workers' Committee (Ministry of Reconstruction).—To consider and report upon the arrangements which should be made for the demobilization of workers engaged during the war in national factories, controlled establishments and other plants engaged in the production of munitions of war and on government contracts or in plants where substitute labor has been employed for the duration of the war.

Horse Demobilization Committee (War Office).—To frame proposals for the demobilization of horses and mules in relation to the general scheme of demobilization.

Disposal of War Stores Advisory Board (Ministry of Reconstruction).—To expedite the preparation of any necessary inventories of property and goods of all descriptions held by government departments, and to consider and advise upon the disposal or alternative form of use of any property or goods which have or may become during or on the termination of the war surplus to the requirements of any department for the purposes of that department.

Labor and Employment

Committee on Relations Between Employers and Employed (Ministry of Reconstruction)—(1) To make and consider suggestions for securing a permanent improvement in the relations between employers and workmen; (2) to recommend means for securing that industrial conditions affecting the relations between employers and workmen shall be systematically reveiewed by those concerned with a view to improving conditions in the future.

Women's nployment Committee (Ministry of Reconstruction)—To consider and advise in the light of experience gained during the war upon the opportunities for the employment of women, and the conditions of such employment in clerical, commercial, agricultural and industrial occupations af ter the war.

Aliens Committee (Ministry of Reconstruction).—To consider (a) the questions which will arise at the end of the war in connection with the presence in this country of persons of an enemy nationality and whether the repatriation of such is desirable, and if so, in what cases; (b) what restrictions, if any, should be imposed after the war on admission of aliens to this country and their residence here; (c) whether any changes in the law or practice of nationalization have been shown by the experience of the war to be required in the public interest.

Interdependent Conference on Missions in India.—To consider the conditions on which aliens should after the war be allowed to conduct missionary or educational work in India.

Civil Aerial Transport Committee (Air Ministry).—To consider and report to the air board with regard to (1) the steps which should be taken with a view to the development and regulation after the war of aviation for civil and commercial purposes from a domestic and imperial and an international standpoint; (2) the extent to which it will be possible to utilize for this purpose the trained personnel and the aircraft which the conclusion of peace may leave surplus to the requirements of the naval and military air services of the United Kingdom and overseas dominions.

SEVERE COLD working of a metal is apt to produce the form of decay known as seasoning cracking. Hard drawn brass rods and tubes occasionally crack, both in use and in storage, when transferred to a warmer climate or exposed to slight corrosion. This decay is due to the existence of severe internal stresses in the metal caused by the unqual deformation of the inner and outer layers. The cracks are commonly transverse. While seasoning cracking is generally hastened by exposure to temperatures above normal, heating sometimes prevents this form of decay. Seasoning cracking may also be caused by ammonia or other agents; when the chemical agent acts rapidly the cracking may occur with almost explosive violence. Very hard drawn rods of brass or bronze will sometimes fly to pieces when attacked with a solution of a mercury salt or of ferric chloride.

A SUITABLE varnish for rust prevention can be manufactured from the following recipe:—Resin six parts, sandarac nine parts, gumlac three parts, turpentine six parts, and rectified alcohol nine parts. The resin, sandarac and gumlac should be mixed together in a pounded condition and then carefully heated until melted. When they are well melted, the turpentine should be added very gradually, stirring all the while. The mixture should then be digested until dissolution takes place. Then add rectified alcohol up to the amount stated above. It should afterwards be filtered through fine cloth or thick filter paper and preserved in well-stoppered bottles so that no evaporation can take place.

FROM THE MEN WHO PRODUCE

Methods, Machining Devices, Systems and Suggestions From Shop And Drafting Room

HANDLING MATERIAL FOR ASSEMBLIES

By D. O. Barrett

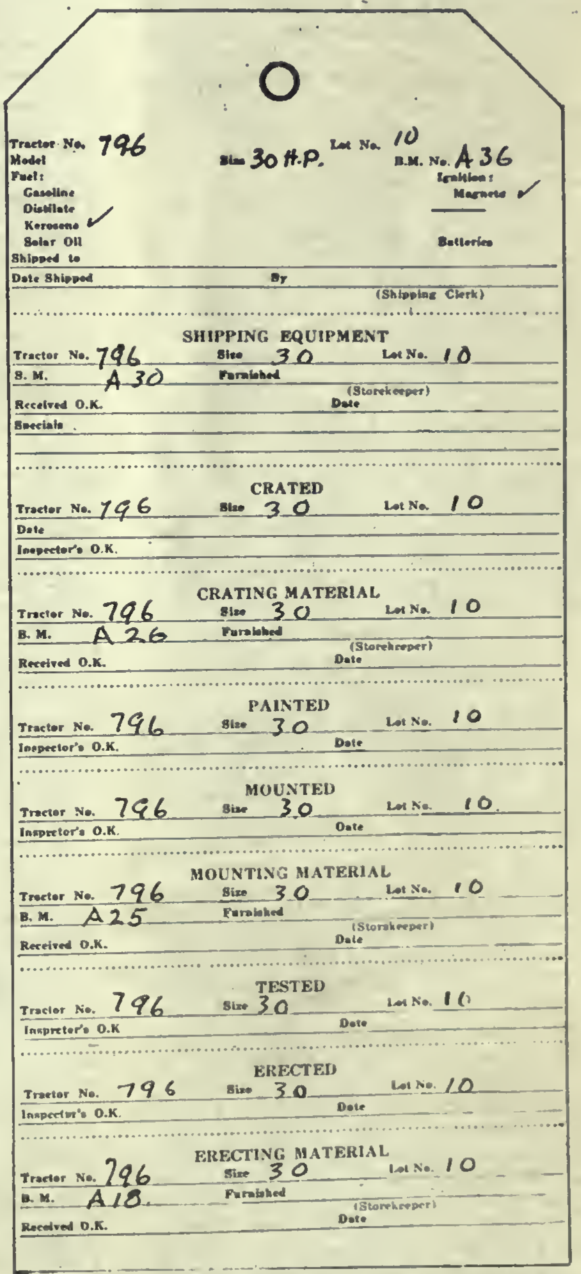
IN any establishment involving the assembling of finished stock the basis of all recorded observations is, of course, the bill of material listing the various parts to be used, together with sizes of same, kind of material, and any other pertinent information. These bills are made out for all the smaller units of the machine which may be assembled and carried in stock as such. The general bill will then cover the entire machine, this comprising the various assemblies together with the other items necessary.

A sample bill of material is shown for a piston assembly for an oil engine, the rod and rings being fitted and the whole carried as a unit entering into the final assembly of the engine. It is not the purpose here to enter into any lengthy discussion of stockroom practice but merely to show a couple of methods which have been used to cover the transfer of stock to the assembly floor and give a complete record of same, enabling an accurate cost to be obtained of the finished machine.

The long card shown was used in the assembling of farm tractors. When the order came to the shop to assemble a certain number of machines the cost clerk made out one of these cards for each tractor in the lot, this bearing the serial number as well as designating the type and any specials to be carried. This card constituted the order on which the assembly foreman built the machine. When ready to start work, the bottom stub of the card was removed and turned into the stockroom which then supplied all the material called for on the bill specified. The stockkeeper then returned this stub to the cost clerk, who checked out of "finished stock" and charged to "work in process," the complete bill of material. The card was perforated between the various stubs so that these could be easily removed. A rubber stamp was used in filling in the card with tractor number, size, etc. This tag was tied to the tractor in a conspicuous place so that it could be inspected at any time during its progress. When completely erected the inspector removed the corresponding stub and sent in with his O.K., the tractor then going to the test shop, and as each operation was completed the corresponding stub was sent in to the cost clerk so that the man in charge of production could tell at a glance where any certain tractor was located and whether production was being kept up to the predetermined schedule. No requisitions were required to secure any material as the proper stub served this purpose while all reference to the amount of material necessary was made to the original bill of material as specified by number on the stub. This method worked very satisfactorily as it enabled a careful check at all times on machines going through the shop.

In the building of large oil engines the conditions were somewhat different from those encountered in the manufacture of tractors. Where the latter could be put through in large lots it was often necessary for the assembler to work on several of these larger engines before one would be entirely finished. It was quite a job for the stockkeeper to record all the various material as called for as it was obviously impossible to deliver the amount for a complete engine at one time. Mistakes were constantly occurring in trying to charge off the various items from the stock cards which, in this case, were kept in the stock room. To obviate this trouble a combined bill and checking list was printed, one of these being made out for each engine at the time the assembly order was given. Of course the most of the information at the top of the sheet could not be entered until the engine was shipped.

Several sheets were required for a complete engine and these were bound together, being practically a repetition of the general bill of material though it did not replace this and was intended to be used for all the various sizes of the same type. As the material was called for and issued a small rubber stamp was used



Tractor No. 796 Size 30 H.P. Lot No. 10
Model B.M. No. A36
Fuel: Ignition:
Gasoline Magneto ✓
Distilate
Kerosene ✓
Solar Oil Batteries
Shipped to
Date Shipped By
(Shipping Clerk)

SHIPPING EQUIPMENT
Tractor No. 796 Size 30 Lot No. 10
B. M. A30 Furnished
(Storekeeper)
Received O.K. Date
Specials

CRATED
Tractor No. 796 Size 30 Lot No. 10
Date
Inspector's O.K.

CRATING MATERIAL
Tractor No. 796 Size 30 Lot No. 10
B. M. A26 Furnished
(Storekeeper)
Received O.K. Date

PAINTED
Tractor No. 796 Size 30 Lot No. 10
Inspector's O.K. Date

MOUNTED
Tractor No. 796 Size 30 Lot No. 10
Inspector's O.K. Date

MOUNTING MATERIAL
Tractor No. 796 Size 30 Lot No. 10
B. M. A25 Furnished
(Storekeeper)
Received O.K. Date

TESTED
Tractor No. 796 Size 30 Lot No. 10
Inspector's O.K Date

ERECTED
Tractor No. 796 Size 30 Lot No. 10
Inspector's O.K. Date

ERECTING MATERIAL
Tractor No. 796 Size 30 Lot No. 10
B. M. A18 Furnished
(Storekeeper)
Received O.K. Date

FORM USED IN ERECTING, TESTING AND CRATING TRACTORS.

BILL OF MATERIAL.

THE BROWN ENGINE CO.

Date..10 - 18 - 17..

B.M. No.....12......

Assembly..........PISTON, 10"...............

No. Sheets...1......

Type...Stat......Symbol....K....H.P....40....

Sheet No...........

No. Req'd.	Part Number.	Name of Part.	Material.	Size.	Draw. No.
1	K160	Piston.	C.I.	10"	825
5	K165	Piston Ring.	C.I.	10"	830
1	KL170	Piston Rod.	C.R.S.	2" x 48".	825
1	KL171	Piston Locknut.	S.F.	2" Half.	
1	KL172	Piston Rod Nut.	S.F.	2" Full.	

BILL OF MATERIAL USED IN TRACTOR WORK.

to record the date in the proper column. As much information as possible concerning the engine was put on the sheet so as to form a complete and permanent record which might be used later for reference should any repairs be ordered. In engines of this size it is impossible to discard pieces which may not come exactly to specified sizes and another piece may be especially made to fit them. Naturally, if some record is not made of this, trouble will occur later should a duplicate of one of these pieces be ordered. When the engine was completely assembled the material was all charged off the stock cards. No material other than called for on the regular bill of material was given out and, should any be needed, it was necessary for the assembler to secure a requisition from the foreman and the material was then entered on one of the blank lines.

When the sheets were sent to the office the prices were filled in from the cost cards and the value of the completed engine as shipped, obtained. For the class of work for which it was used this method gave results which were accurate and with a minimum of labor.

BABBITTING BEARINGS

By D. A. Hampson.

"M. H. P.'s" article on babbitting in the May 16th issue is so complete and so clear that one hesitates to add anything to it. However, a few supplementary thoughts may not be out of place entirely.

When babbitt is heated in a pot and poured from ladles dipped in the pot chilling is bound to occur. If cold ladles are dipped in the molten babbitt the temperature of the babbitt in both the ladles and the pot is considerably lowered—often so much that by the time the second ladleful reaches the bearing it is entirely too cool to attempt to pour. A remedy for this trouble is to heat the ladle or ladles with the babbitt as soon as it softens up; with this method the ladle is of the same temperature as the babbitt when pouring begins and the first and subsequent dippings do not start wrong by cooling the metal far below pouring temperature.

The writer has poured plenty of bearings with paper wrapped around the shaft, but must confess that in the hands of the average workman, who only runs a bearing once in a while, the method can not be called a success. On a rough job, where the object is simply to fill a hole or where the bearing is to be bored, the paper may do, though it is fussy at best, and he who doesn't get the babbitt inside the paper at times is lucky indeed. If a lubricant is desired to get the mandrel out easily or as a protection for the shaft, a coating of red or black lead is about the best thing going. Red lead is obtainable at the most distant jobs; if rubbed on the mandrel evenly and heavy enough so the latter shows its own color just faintly, the bearing when poured will be a running fit and needs but a touch with a scraper. In manufacturing a line of machines which required a good many square threaded babbitted nuts one of the slowest jobs was to get the screws out of the nuts and to scrape and tap the nuts to a decent working fit. The writer

BILL OF MATERIAL AND CHECKING LIST | *Sales Order No.* 1913A *Date Issued* Jan. 5-1918.

Customer Ajax Supply Co *Address* Denver, Colo.

Their Order No. 389 *Date* 12-22-17 *Wanted* Mar.1-18 *Shipped* Feb 28

Engine No. E3728 *Horsepower* 45 *Bore of Cylinder* 10".993

Shipped to Wm. Jones *At* Sioux Falls Iowa.

Car Initials and Number D.&H. 149033 *Routing* C.&N.W. & M.&O.

QUAN. REQ.	PART NO.	NAME OF PART	DESCRIPTION	DATE ISSUED	PRICE
1	1	Base		1-10-18.	
1	4	Top bearing—short		1-11-18	
1	5	Top bearing—long		"	
		Babbitt for bottom 47# Triumph, 19# Emco.		"	
		Babbitt for top 39# No4.		"	
4		Shims	Fiber.	"	
1	10-R	Bearing cap—gov. side		1-12-18	
1	10-L	Bearing cap—pull side		"	
4	16	Top bearing clamp screws	1" Hex x 5⅞"	"	
8		Nuts—full 1"		"	
4	14	Wedge adj. screws			
1	7	Wedge—short			
1	8	Wedge—long			
4		Adjusting screw pins	¼"		
2		Cam case cover screws	½" x 1¼"		

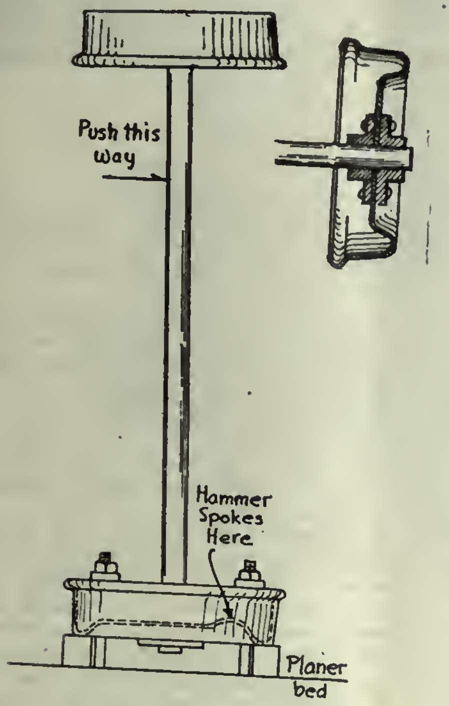
QUAN. REQ.	PART NO.	NAME OF PART	DESCRIPTION	DATE ISSUED	PRICE
1		Drain cock	½"		
1		Drain cock	⅜"		
1		Drain plug	⅜"		
2	Z 230	Spray plug assembly	S. M. No. 18		
1	Z 260	Fuel pump assembly	B. M. No. 17		
		Fuel line bottom—to pump			
1		Tee ½"			
1		Plug 1½"			
2		Nipples ½" x 4"			
1		Union Grd Joint ½"			
1		Street Elbow ½			

SHIPPING EQUIPMENT.

QUAN. REQ.	PART NO.	NAME OF PART	DESCRIPTION	DATE ISSUED	PRICE
1		Friction clutch complete	BM# 39.		
		60" x 16" x 4 7/16" Pulley — 1⅛" K.s.			
1		3 H P engine complete	10" Pulley.		
		On Skids.			
1		Filler	3 Gal.		
1		Torch	Gas.		
1		Starting bar			
2		Fly wheel wedges			
30 ft.		3" ~~rubber~~ belt	Canvas.		

BILL OF MATERIAL AND CHECKING LIST FOR TRACTORS.

tried the red lead scheme on the nuts and did away with all those slow processes at one stroke. The lead (powder) is mixed to the consistency of paint and applied to the screws with a brush; this gets it on the sides of the screw as well as top and bottom. The screws, after pouring, are turned out of the nut with a ¾-in. lathe dog, though the dog is needed only for a starter, for as soon as



METHOD OF STRAIGHTENING WHEELS.

started the screws can be turned by hand and are found to be a first-class running fit without shake.

A mistake made by too many is in not providing means for the air to escape. It is not uncommon to see babbitt blown fifteen feet in the air by failing to provide an escape for the air which was trapped and compressed. If an unusually large pouring hole is provided the stream of babbitt being poured does not shut it entirely, and an outlet is thus provided. But in most small work we see one or two ¼-in. holes, one or both of which are used for pouring holes. If only one hole is used for pouring, the air can escape from the other very nicely, but if there is only one hole (and that of such small size) that rarely is sufficient, and we have a demonstration of that old principle of physics that "two bodies cannot occupy the same space at the same time."

Too small a pouring is bad practice in any case where a larger one can be put in. A ½-in. hole is as small as should be used; it gives the workman a chance to "hit the hole" with the babbitt and also to let out a little air. But with the large hole, one or more small ones for the air to get out are advisable; if the casting is intricate, they help greatly in filling up all over. And once the pouring has been started, it should be kept up just as fast as the metal will run through the hole—better faster than slower.

STRAIGHTENING A CAR WHEEL

By M. I. D.

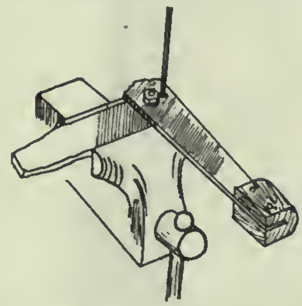
Pressed steel wheels are fast replacing cast iron ones for service on hand and gasoline propelled rolling stock used by inspection, electrical, and track gangs on our modern railroads. A section through a typical wheel is shown in Fig. 2. The steel is ¼-inch thick, it is centred in a cast hub, and driven through a 1½-inch axle. Every once in a while one of these axles would get bent and would be brought in for us to straighten. At least, the men said the axles were bent—we invariably found the fault to be in the wheel.

Our way of straightening the wheel is shown in the accompanying sketch. The wheel was first tested to locate the high side, in the lathe if the bend was small and by eye if it was very noticeable, and then the assembly was clamped on the bed of a heavy planer with the bad wheel down. This wheel was clamped so the bend was in the direction of the length of the bed. Two men stood on the planer and, using the axle as a bar, pushed and pulled in the right direction while a third hammered on the kink in the "spoke." By bending and trying, the wheel would be straightened in short order, often a badly bent one being fixed in a half hour's time. The axles were invariably of a size to resist any deformation during the work.

A MILLION PIECES OF HARD WIRE —HOW THEY WERE CUT OFF

By D. A. Hampson.

One of the operations in a munition job that the shop had taken "on contract" was to cut up a million pieces of ⅛-inch spring wire in various lengths from 1 inch to 30 inches. Now the shop had handled quite a little wire work in times past and had cutters for various sizes of a type shown in Fig. 1. Two worn-out files would be softened, teeth ground off one side of each and tangs cut off, and a pivot bolt put through one end. Then a hole to suit the size of wire to be cut would be drilled quite close to

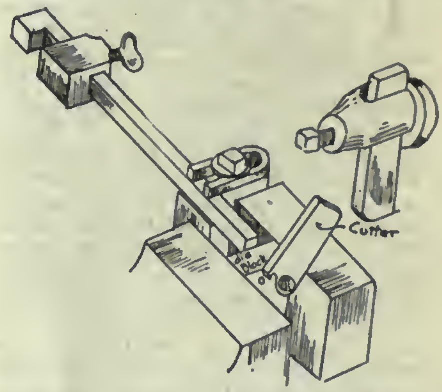


HAND SHEAR FOR CUTTING WIRE

the pivot and the ex-files hardened again. In use one of the blades would be held in a vise and the other, drilled to stand at right angles, would be pulled by hand to cut the wire. This made cheap, durable, and always obtainable cutters but not applicable to so many pieces at a time or such hard wire—besides being too slow, it would develop a sore hand squad of too large proportions.

Fig. 2 shows the wire cutter as made up and operated in a not-much-used shaper. A tool steel block with a hole for the wire to slide through is held in the shaper vise. The block carries a cutter kept up close by a shoulder screw and returned by a coil spring. A piece in the tool post strikes the cutter at each forward stroke and shears off the wire. The hole in the block is tapered up to within ¼ inch of the cutting edge running back to ⅝-inch at the rear and making it easy for the workman to find the hole with the wire. Straightened spring wire in standard three-foot lengths was purchased. In cutting up, the longest lengths were cut first, followed by shorter ones down to the smallest and reducing the waste to almost nothing.

There were in use in the shop gauges of the sliding jaw type with bars of

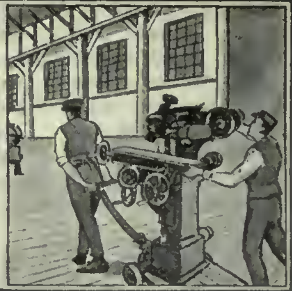


CUTTING A MILLION PIECES OF WIRE IN A SHAPER.

about 1 inch square section. One of these was requisitioned as a stop for length and clamped so the adjustable jaw was in line with the cutting hole in the block. This formed a most convenient arrangement and like the rest of the outfit tied up very little money in special tools to be discarded when the job was over. With the shaper running at forty strokes a minute, the operator was able to cut a wire every other stroke. But four sharpenings were necessary on the entire job, less would have done but for the fact that a very square end and a round wire right up to the end were required.

IN SOME hydraulic power stations there is, at certain seasons of the year, a surplus of energy available, which is commonly unavoidably run to waste. This has been the case (says Engineering) at the Leten power-station of the Zurich Electrical Power Company. At the same time it has been necessary to maintain for certain purposes a small steam plant. The company accordingly decided to utilize the surplus of power available for maintaining steam in a boiler for this plant. The boiler fitted has 1,800 sq. ft. of heating surface, and, with a maximum consumption of 84 to 86 kw., is able to supply 3,800 lb. of steam per twenty-four hours, which suffices to run the feed-pumps and to keep hot the machines and the piping.

DEVELOPMENTS IN SHOP EQUIPMENT



Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

IMPROVED FLOOR TYPE BORING, MILLING AND DRILLING MACHINE

THIS machine is driven from a motor mounted on top of the column. The drive is direct connected to main drive shaft, there being no belting whatever involved in this design. The spindle drive is controlled by a pair of friction cone clutches, located at back of saddle, and accessible for adjustment. This arrangement provides a reversal of spindle for back facing and tapping. The driving pinion for the spindle meshes with a large diameter gear face cut directly on the face plate. This location of spindle drive prevents spindle torsion, and as a result eliminates one of the most frequent causes of chatter when milling. The front end of spindle slides through an adjustable bearing carried in the spindle sleeve, but the spindle does not rotate in this bearing. The rotating motion is taken in another adjustable bearing, and on the external diameter of the spindle sleeve. The advantage of this design is a provision of take-up for wear on the sliding spindle bearing.

A very prominent feature of this tool, and one which is exclusive in this design, is the sensitive and powerful concentric screw feed of spindle, accomplished by means of a differential train of gears. The only thing that limits the length of spindle feed when it is traversed by this method is the factor of practicability, as there is no mechanical limit of feed, such as is encountered with a rack and pinion or an auxiliary screw feed. This method of feeding permits continuous traverse of spindle without resetting. The feed is applied between main bearings, requiring no overhanging support at end of saddle.

The spindle is traversed by a long bronze nut which engages square thread on the spindle, and which has a bearing only on the sides of the spindle thread. It will be seen that this arrangement provides a very long bearing, and as the two rotate together at the same rate of speed, except when feed is engaged, the possibility of wear is very remote. However, in case of wear, there is an adjustment to take it up. The end thrust in either direction is taken on ball bearings

The thrust of spindle when milling is taken in a most rigid manner, directly on the main saddle casting, and is entirely independent of the end thrust of spindle for boring. The principle of carrying feed and speed gear trains in the saddle as one unit lends to the machine a facility for operation not readily surpassed.

There are twelve changes of speed, and twelve changes of feed embodied in this design. All feeds are at the same rate per revolution of spindle, whether applied to spindle, saddle or column traverse, and no two of them can be engaged at the same time. It is notable in connection with this speed and feed arrangement that any one of the twelve feeds can be applied to any one of the twelve spindle speeds, making in reality one hundred and forty-four actual rates of feed. Power rapid traverse, independent of the regular feeds, is provided for spindle, saddle and column in every direction. With one lever, machine can be instantly started and stopped, or reversed, independent of main drive or motor.

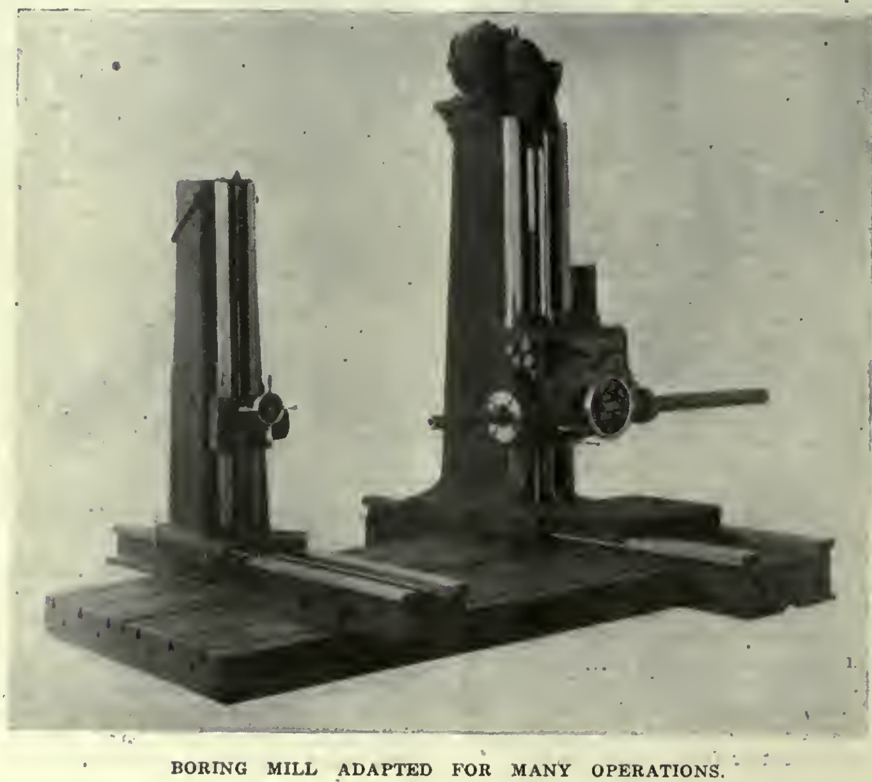
The gear shifts are all of the sliding transmission type, and are tightly and neatly enclosed, a feature that adds not only to the life and appearance of the machine, but also provides that safety for the operator so essential to State law requirements and rapid production of work.

All traversing gears are located consistent with the most approved methed of design, that is, between the ways, and close to the guiding side.

The gears and shafts are made of chrome nickel steel, specially heat treated. The spindle is made of high carbon hammered crucible steel and accurately ground to secure correct alignment.

The oiling of the saddle parts is accomplished by the syphon system, which insures a continuous supply of clean oil to the bearings. The counterweight for the saddle operates inside the column, out of the way of the operator, thus assuring safety in accordance with State laws.

When this machine is correctly aligned in position with the rigid outer support column, and the wide, unyielding floor plate, it possesses to a remarkable degree those features which make it an indispensable tool in factories and shipyards handling a variety of massive



BORING MILL ADAPTED FOR MANY OPERATIONS.

castings which must be machined accurately and quickly.

After several years of experience, designing and experimenting in a very practical way, the manufacturers of this machine are thoroughly convinced of its high efficiency under severe service. One of its greatest advantages is its universal range of adaptability. It may be used to bore, mill, drill, tap, spline, and for oil grooving or rotary planing at one setting. When swivel table is used, the different sides of work may be finished without resetting. The design of this machine is such that its actual manipulation requires a relatively low proportion of the operator's time, creating a wider opportunity, and a greater incentive, for him to increase production.

GEAR BOX WITH COVER REMOVED SHOWING MECHANISM.

This machine, of improved design, is built by the Landis Tool Company, of Waynesboro, Pa. It has been designed especially to meet the requirements in a general way, of shipyards, navy yards, turbine works, etc., and will handle a wide range of heavy machine work. Briefly it combines the necessary durability and simplicity of operation to insure accuracy and quantity of all work usually machined on floor type boring machines.

JULY MEETING OF ONTARIO SECTION OF A. S. M. E.

A well attended meeting of The American Society of Mechanical Engineers, Ontario Section, and the Toronto Branch of the Engineering Institute of Canada was held in the lecture room of the Engineers' Club on Wednesday evening, July 3. Two subjects were presented.

The first was a very interesting paper by Mr. Edward Maybee on "Patents of Invention." This covered particularly the part of the patent field of interest to engineers and a number of points which are generally not well understood were explained in a very clear and interesting way by Mr. Maybee.

The second subject was an address by Mr. Holmes of the Invalided Soldiers' Commission on "The Training of Disabled Soldiers in the Industries." The training of returned soldiers falls into three classes—that of the hospitals, then in the re-education schools and lastly in the shops of the industries themselves. With this last department Mr. Holmes dealt and explained the organization and methods of handling the work. It is with this industrial phase of the training that the engineers and employers should be closest in touch. It is here that they can help most.

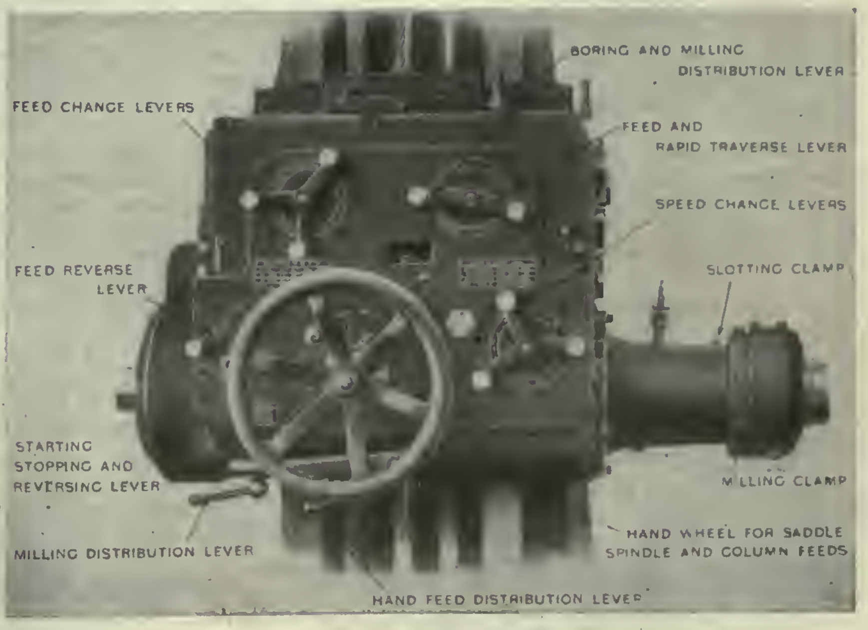
Mr. Holmes explained how the preliminary survey is made of each plant before men are placed there and that a careful supervision is kept over the men and their work by the Government Commission during the period of their instruction. The men receive pay from the Government and instruction from the firm. Over 90 per cent. of the men so placed have made good and are now earning or making good progress towards earning a comfortable income.

The principal point brought out was that the returned men should not be dumped upon the industrial field and left to shift for themselves but their cases must be studied individually and the men allotted to positions suiting not only the man's natural capacity but also the nature of his wounds or physical deficiency.

PERMANENT EXHIBITION OF MACHINERY IN NEW YORK CITY

A permanent display and salesroom for machinery and mechanical appliances is being planned in New York City, to be operated by what is known as the Merchants and Manufacturers' Exchange of New York, the display and salesroom being located in the Grand Central Palace, Lexington Ave. and 46th St. The machinery exhibition will occupy an entire floor of the building, having an area of 50,000 square feet of floor space. For the convenience of the buyer, a general information bureau and reading room will also be maintained where important trade and technical journals and catalogues will be kept on file. All communications should be addressed to the Machinery Sales Department, Grand Central Palace, New York City.

KAING GRASS grows in great profusion in all parts of Burma, frequently reaching a height of 10 ft. As a paper-making material it may be classed with esparto grass, and is much cheaper, though the quality of the pulp is not quite so good as that obtained with esparto.



FRONT VIEW OF GEAR BOX.

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COAL AND COLD

ADVICES from all coal producing centres in Canada and the United States reveal a similarity of opinion regarding the coal situation which demands all the attention and action which it is possible to give.

Some time ago it was stated that no coal would go to Montreal from Nova Scotia this summer for the simple reason there are no ships available. While there may be some small amount taken up by rail, the great bulk of the fuel supply must be water-borne during the shipping season.

It is now stated that the Nova Scotia coal output continues to decrease. Commenting on this the Sydney correspondent of CANADIAN MACHINERY writes:

> "For the first six months of 1918 the production has fallen off from the record of the first six months of 1917 by about 330,000 tons, and it is only too probable that by the end of the year the total outputs will be less than those of 1917 by about 330,000 tons, and it is only too probable that by the end of the year the total outputs will be less than those of 1917 by almost half a million tons. At the same time it is hoped the rate of decline in the last half of 1918 will not be so rapid as it was during the last six months. That is the best that can be hoped for."

The problem of coal production is not the least of the problems that face the Allied leaders, and if the coal production declines to a point where it restricts the output of munitions and the transport of troops the gravity of the situation will appear in its true light. According to our authority quoted above things are approaching such a point that if activities vital to the success of the war are touched the private consumer will have to freeze, if need be, because the needs of the army and navy come before the requirements of people at this time.

U.S. LABOR DEMAND RECEIVES OFFICIAL COGNIZANCE

SCARCITY of common labor and lack of workers in the coal mining industry are imperiling all other war production in the United States at the present moment.

A shortage of between 300,000 and 400,000 common laborers exists in the war industries across the line, while the skilled labor supply is also seriously inadequate as evidenced by the fact that one large munitions plant turning out heavy calibre guns is short 2,000 machinists, while the war plants of Connecticut and Maryland alone are undermanned by 35,000 skilled machinists. Immediate relief is sought by assigning the United States Employment Service to act as a centralized government agency in recruiting workers for war work from the non-essential industries as quickly as possible, in view of the amount of work which will devolve upon it after August 1, after which private recruiting for unskilled help for war work becomes effective.

That the machinist's work is vital to the success of the war is shown by the decision of the authorities in the States to ultimately extend the ban to include skilled workers, the mobilization of whom will also be handled by the Federal Employment Service, assisted by the International Association of Machinists, affiliated with the American Federation of Labor, who are putting their whole weight behind the war labor supplying program.

An absence of labor troubles from now on would seem to be likely in view of the fact that deferred classification of all skilled machinists registered in the draft, and furloughs of skilled machinists now in military service are advanced as chief remedial measures.

OUR NEED FOR SHIPS

THE argument has several times been advanced in these columns that Canada must consider the establishment of a shipbuilding industry on a permanent basis if we are to place our products, and particularly our manufactures, in those markets where they can be disposed of to the best advantage. Foreign nations may seek out agricultural products with their own ships but they will want to bring manufactured goods to our shores, not to take them away.

This argument is appealing in the United States in a somewhat different way. In an address before the Illinois Manufacturers' Association, Edward N. Hurley, chairman of the United States Shipping Board, declared that the United States would be in such a favorable position as regards tonnage after the war that it was up to the manufacturers to increase their output so that the ships might be operated to advantage.

If the United States has plenty of ships after the war and Canada has but few it does not take a great deal of figuring to arrive at a conclusion as to which country will be in the best position to develop foreign trade.

SIGNS OF THE TIMES

LABOR and material are the two principal foundations on which organized industry is based. Take away either of these and the other, along with such resultant activities as consumption, distribution, etc., is completely nullified.

This interdependence is proven by the action of the Ford Motor Co., of Canada, the closing of whose factory is attributed to difficulty in obtaining materials coupled with labor troubles.

The universality of the company's products was such that, combined with the known profitableness of its business in the past, its retirement from active business, even though only temporary, is another indication of those changes in business which are taking place slowly but surely, and which have in the course of the past two years brought home to us gradually the present state of world affairs.

That the entry of the United States into the war would have certain far-reaching effects on Canadian industry was admitted by many, but the man in the street has not yet realized the extent to which business is restricted by legitimate measures originating at Washington.

Although Ford cars may not be made in Canada for the present their price does not bring them within the category of banned imports, but the closing of an establishment which has had an annual output approaching 30,000 cars will bring home the true aspect of affairs much more effectively than the prohibition of some particular grade of metal on which comparatively few people ever cast eyes.

CANADA BURNING HER NATURAL WEALTH LIKE A DRUNKEN SAILOR SPENDING HIS MONEY

CANADA is burning up her natural resources and her wealth at the same pace as a drunken sailor spends his cash. Of course the official reports do not put it that way. They state total figures and leave the public to draw its own conclusions.

Apparently Canada is going to lead in a few things, so the Dominion breaks into the head of the procession, and is able to announce that as far as a per capita fire loss is concerned it leads the world.

Something to be proud of and get enthusiastic over, isn't it?

Canada's rate is $2.73 for every man, woman and child. Put the thing in a table so it can be seen and appreciated. It looks like this:—

Canada	$2.73
United States	2.26
England	.64
France	.74
Germany	.28
Switzerland	.13

Well, that's one thing to talk about. We've got the Germans beat ten to one at burning up and destroying property and natural wealth.

Since Confederation

Since Confederation the fire loss in Canada, excluding forest fires, has been $700,000,000. Of this sum $350,000,000 is made up of direct fire losses, $150,000,000 represents the cost of maintaining public and private fire protection services, whilst $197,000,000 is the amount of insurance premiums paid, but not returned to policy-holders in compensation for losses. In addition, nearly 200 people are burned to death and about 500 seriously injured by fire every year. In the four normal years, 1912-15, Canada's annual per capita fire loss was $2.73.

The Timber Losses

Just how great has been Canada's timber loss from fire is not known. It cannot be computed. At best it can simply be guessed at or estimated. British Columbia has paid a great price for having all the fool fire setters loose in that province. The railroads have done a nasty lot of business for that province, but the roads have done a lot better in recent years.

The camper has done his bit to burn up forests and settlements and bridges. There have been campers and prospectors tearing loose over the mountains of British Columbia who wouldn't know enough to eat out of a nose bag when the whistle blew for noon. The experienced bushman, the timber cruiser and the prospector—these men don't start fires. They know all too well what it means. They know the horror of the wall of fire, of the poor meagre chance of beating the fire to a lake or river. They put their camp fires out when they're through and they don't drop burning matches.

A Sorry Spectacle

The foothills of British Columbia bear silent and tragic witness to what fire has done there. Great stretches of timber, the heart and life burned out of it, charred, barren and good for nothing except firewood—and no person is keen for firewood in a land teeming with coal.

The story of British Columbia's forests is the story of Canada's industrial and domestic life as far as fire is concerned.

And the most damning part of it all is that there's no excuse for it.

The best proof of this is actual experience. Take the case of the Massey-Harris plant in Toronto. In 30 years the fire loss has not amounted to $500.

It has cost them something to keep up their own fire department. But they have realized on that investment.

Other Extravagances

And the method of carrying on insurance business is extravagant, according to reports of the Conservation Commission. From 1869 to 1916, the public has paid the insurance companies 65 cents for distributing every dollar of indemnity. This gives food for thought, when it is remembered that, under present Government management, the collection of customs and inland revenue costs less than five per cent. of the receipts. Since the establishment of Government insurance in New Zealand in 1905, the rates on mercantile risks have been reduced 10 per cent. and on dwellings 33 and one-third per cent. The report asserts that insurance agents in Canada are paid, on the average, a commission of slightly over 20 per cent., obviously a large expenditure on middlemen. It is also stated that the number of agents is excessive, a circumstance which makes necessary a higher commission than is economically necessary.

The whole system—pardon the word—of burning up property and carrying insurance in Canada is a long way from being what it should be. There's a grand chance for some good stiff punishment for our fire fiends, and a splendid opportunity for a generous rattling of dry bones.

Preventible fires are nothing short of national robbery, and it's time to call a quick halt to this form of plundering the common storehouse of Canada's wealth.

There's a Heap of These Men

The phrase we hear "grass widower," is a piece of slang, of course, it really means a lonely man, a victim of remorse. His wife has gone, his family, too, to seashore or to stream, or to the country there to sip of honey and of cream.

And Henry John, he stays at home to dwell in single bliss, and murmurs—to himself, of course—there ain't no life like this.

He tells the folks who live next door he is one lonely coon, and he hopes the woman of his heart will hike back awful soon. He sets his table a la carte, he dines in lavish style, he heaps the dishes in the sink—a great and glorious pile.

"The boys" drop in to comfort him, to cheer his weary hours, to help him shuffle up the deck and shake the king and bowers.

They help him wash his woes away with fellowship divine, while Henry brings the wash upstairs in cold and sparkling wine. He helps his guests down off the porch, this man chuck full of sorrow, and hopes they'll be in shape again to go to work to-morrow.

At other times he greets the girls with most profuse salaam, and goes a fierce, blood-curdling pace for a decent married man.

He dons his Sunday meetin' clothes and wears 'em through the week, and smokes cigars and cigarettes until the curtains reek. He leads a whirlwind pace, by gum, this bachelor pro tem, you'd never think of naming him the loneliest of men.

Then once a week he writes a line to the woman of his choice, and tells her he is dying sick for the music of her voice.

He writes an awful hunk of lies, sends kisses to the kids, and says he needs a home-made meal to fortify his ribs. Of course he tells her not to mind about his sorry plight, although he sheds a peck of tears as he thinks of her each night.

But he tells her just to stay right on and finish her vacation, and that for her he'll willingly forget his desolation.

This letter reaches dear Lucille, she bubbles o'er with pity, to think of her dear Henry John a-swelterin' in the city.—Ark.

MARKET DEVELOPMENTS

The Old Tin Can Is Receiving Attention

Restrictions Being Placed on its Manufacture in United States—War Board Insists on Selling Price Being Mentioned in Every Case—Metals Have Advanced in Several Lines During Past Week

APPARENTLY the War Board at Ottawa has decided on the question of price regulation, and events show that they are not to be turned aside by objections on the part of dealers. Orders for release of material from warehouses that do not include in the information the selling price per pound are promptly returned. Apart from that there is not any tightening of the regulations at Ottawa, and the general run of orders get through all right. As a matter of fact it is amazing the number of industries in Canada that are indirectly engaged on war work. Orders for repairs on plants in nearly every case can be traced to war work on either first or secondary contracts, and in this way sufficient warrant is found for passing on the request for supplies of steel or other much-wanted war materials.

United States government is taking steps to spread out the available supply of box tin, and to keep it from being used for anything that can stand aside for the time being. Canners are denied access to the tin market in some cases until the middle of September, and in other lines the canning of certain products is stopped, as it is considered that a sufficient supply is on hand for immediate requirements.

Dealers in scrap metals in a large way are interested in the much-talked of proposal to scrap the railroad running from London to Port Stanley. Any big lot of scrap would be acceptable to the market at this time, although it is debatable if much of the trackage would ever get to the scrap yards, as the demand for rails for re-laying is keen, even for the 60-pound type such as is used in the London road. A mile of such track represents about 100 tons of metal in the rails alone.

There is not much change in the machine tool situation as it has existed for a number of weeks past. Dealers and jobbers are still behind in deliveries of equipment to contractors. The demand for production of munitions is still persistent and continuous. One large Toronto plant has finished the first operation on its British contract, and starts at once tooling for American business. Forgings for this contract, it is understood, will be done in Toronto, so that there will be very little hauling between the point of forging and machining.

Price advances in metals have been frequent during the week, the scrap quotations following on after increases in the other lists. Copper, zinc, lead and antimony have all increased.

SHIPYARDS AND MUNITION PLANTS ARE LARGE BUYERS OF MACHINERY

Special to CANADIAN MACHINERY.

MONTREAL, July 9.—Munitions and shipbuilding vie with each other in supremacy of industrial activity. The recent announcement that larger output of shrapnel was desired has stimulated the shell industry, and owing to the reverting of the smaller tools to the production of the 75 m.m. American shell the demand for such equipment has been increased. During the past week the shipyard of Fraser, Brace Co. floated two of the four 3,000 tons wooden vessels, now under construction. Considerable local interest has been shown in the relaxation of priority certificates for steel, but the situation is still one where little surplus steel is available for other than essential needs. Contrary to expectations the price of copper has been advanced to 26 cents. as a result of freight advances and higher cost of production. Machine tool activity has recently increased following the placing of shrapnel orders.

Pig Iron Stronger

As a result of the higher cost of transportation and other conditions the situation has become stronger at the new price recently fixed by the governing board. The 45 cent advance is now effective on Pittsburgh iron, Bessemer being quoted at $36.60 and basic at $33.40 per ton; No. 2 foundry is now $34.40 per ton. Local conditions are unchanged with little iron available for the market, as a consequence no quotations are available.

Steel Unchanged

Although it has been that the priority regulations have been somewhat relaxed, the situation here will not be influenced to any great extent, as the conditions will remain practically the same. As one dealer puts it the priority contracts now at the mills awaiting fulfilment are ample to keep the producers busy for the next six months, so that it will be very small volumes of material that will be available for disposal under the open selling basis. Should operations warrant a continuance of this ruling it would likely be some time before the relief would be felt here. Dealers, however, report improvement in the delivery of steel from the States, but the possibility of securing early shipments of material ordered now appears to be as remote as ever. Semi-finished steel producers are now negotiating with the War Board with the object of arriving at an agreement for revision of fixed prices. Early announcement may be expected in this connection. The market is still one of government requirements and prices here are firm and unchanged.

Metals

The strength of the general market continues and the demand has been steady. Due largely to the higher cost of transportation the prices on some of the metal show a stronger tendency. Copper prices have been revised, tin is unsettled but has declined locally. Spelter is higher under increased demand. Lead has also advanced. Antimony and aluminum are steady and unchanged.

Copper.—The recent action on the part of the U. S. War Industries Board in agreement with the producers, in advancing the fixed price on copper, came as a sudden surprise to the majority, as it was not anticipated that a departure from the old price would be adopted at this time. The uncertainty that has prevailed for the past few weeks as to what attitude the government would take regarding a new price has created a situation that will require some attention before the market can resume a normal tone. Sales that have been made recently for future delivery will necessitate some revision owing to the changed conditions. Buyers may wish to hold the producer to the former price, while the latter may claim the higher price just fixed. However the market or government price of 26 cents will be the basis for the next period's operations, but it may be some little time before normal trading is established. The local demand continues steady but not heavy, and metal is hard to get. Dealers have advanced prices to 30 and 31 cents, this being one cent higher than the quotation of last week.

Tin.—Some relief has been shown in the tin situation but the market is still an uncertain one. Further restrictions have been placed on export of metal from England and the tension here is still pronounced. New York quotations are normal at 92 cents per pound. Dealers here report a better supply with the demand good. Prices asked are easier, a fair average being $110 per hundred; this is 15 cents per pound lower than a week ago.

Spelter.—Interest in this metal has revived as a result of the activity that has recently been displayed by heavy trading in the States. Brass interests are good buyers and the general demand shows improvement. Dealers here quote 11 cents, an advance of ½ cent per pound.

Lead.—Coupled with the advance in American freight rates, the renewed demand for shrapnel has increased the strength of this metal and higher prices are in order. The American trust price is on a par with the open market, the nominal quotation being slightly over 8 cents per pound. Local demand has improved and an advance of one cent places the current price at 10½ cents per pound.

Machine Tools and Supplies

Considerable activity is still evident on every side and the demand for shell making machinery continues to be a characteristic feature. The requirements for the 75 m.m. shell and also the British shrapnel are quite heavy and shell makers are active buyers of used machinery. One firm here which is erecting a new plant to take care of additional business on the American .75 are expecting to obtain equipment in the near future from a plant specially organized to construct the tools required. Dealers report enquiry in excess of the supply and delivery in many cases behind schedule. This also applies to considerable of the accessories that are used in large quantities in munition factories. Shipyards are still good buyers, particularly in the way of the smaller tools, such as air-operated tools, etc.

Scrap Unsettled

Dealers report a quiet situation with little trading. Some business is being done for immediate requirements but future business is dull. Prices are uncertain but unchanged.

POINTS IN WEEK'S MARKETING NOTES

It has been found that in some cases U. S. jobbers had large stocks of steel on hand, which they had been accumulating for years, and holding for fear of running out of certain sizes.

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Advances are noted to-day in several lines of scrap metals, especially coppers. The action of U. S. in raising the price for electrolytic is given as the cause.

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The War Trade Board at Ottawa adheres to the ruling of having the selling price stated on all orders released from warehouses. Orders where this is omitted are promptly returned.

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Orders for boiler tubes reaching Toronto this week are on a scale large enough to clean out most of the local stocks.

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U. S. prohibits manufacture of condensed milk as a measure to conserve the supply of sugar.

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Cans cannot be supplied to preserve beans until the 15th of September. This will release thousands of boxes of tin plate in the next two months.

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Dealers in scrap in Toronto are waiting for developments in the proposed scrapping of the London-Port Stanley road. The rails there should run about 100 tons to the mile, but the chances are they would never be sold in as scrap.

WAR BOARD INSISTS ON PRICE MATTERS

Orders With This Information Left Out Have No Chance to Get Past

TORONTO.—There are firms entering the market to-day for steel, machinery and supplies, and who are now receiving every consideration in the way of preferred treatment, that a year or so ago were not considered to be of much account. In fact some accounts that were begging at that time are now looked upon as good business to handle. The war has practically put them on their feet. And there's quite a chance of a number of these establishments staying in business after the war ends.

But the war and business connected with it continues to be the centre of all deals put through on a large scale now. There are big concerns in Canada now — big enough to rank as right at the top, whose output is at least 85 per cent. on a strictly war basis. The phrase war basis provides a much larger place to work in than might be imagined at first.

There are some disappointments going the rounds in the matter of securing deliveries for promised war purpose machinery. The strike of the moulders a little while back hindered the work in some cases, and other causes have all tended to retard the work. The contractor for shell work who is getting delivery of his equipment on time to allow him to live up to his delivery schedule is a fortunate person.

Advances, quite sharp in some cases, are noted this week in the prices offered for copper scrap, either light, crucible, heavy or copper wire. The reason assigned is the action of United States Government in advancing the price of No. 1 electrolytic copper from 23½c to 26c.

Price Regulation

The War Trade Board at Ottawa is standing pat on its determination to find out the values at which material is passing under permit from the Canadian warehouses. In a few cases orders have gone forward to Ottawa without the blank for the price being filled in. Invariably these orders, although of the war preference sort, are returned at once. Dealers in the great majority of cases show a tendency of playing square with the War Board. They state the price at which they are selling exactly according to facts. "If the War Board decides that we are doing business on too large a margin of profit," declared one dealer to-day, "it will probably give us a chance to get together on the proposition and get our case in the right light at Ottawa." As a matter of fact there is little complaint about orders being turned back from Ottawa. Dealers weed them out before they go through, but even at that there are not as many refusals from Ottawa as there were a few months ago.

Using Large Amounts

Orders placed this week at Toronto for four-inch boiler tubes are large enough to well nigh make a record. Some of them are well into the carload size. The establishment of chemical works here on a fairly large scale, and the nature of the business they are carrying on, means that there will continue to be a large and insistent demand for tubes. In fact it is doubtful if there are many tubes left in Toronto warehouses right now. Buying is becoming increasingly difficult but in spite of that there has not been a tendency to chase the prices up, as it has been a number of weeks since an advance has been recorded in tubes.

Securing Equipment

As the volume of American business being placed in Canada increases there is a noticeable increase in the number of American firms looking for business in Canada. One large Toronto shop that has turned out an enormous number of the six-inch shells on British order is clearing up the last of the work on this. In fact the first operation has been suspended, and the work of tooling for the 9.5 will be undertaken in the course of a few weeks. Forging for this machining is expected to be carried on in Toronto. The American Government is apparently ready to give reasonable encouragement to Canadian firms with good reputation, preferably those that have done well in turning out satisfactorily work on Canadian and English orders. Advances of considerable amounts have been made in several instances. The idea behind it all apparently is that it is the desire of the U. S. Government that production shall begin as soon as possible, and Canadian contractors shall not have to hold back in the rushing through of the work for lack of available funds.

Scrap Metal Situation

Several Toronto firms are awaiting for further developments in connection with the proposed scrapping of the railroad running from London to Port Stanley. In fact Toronto dealers have looked the proposition over several times, and seem to be standing back now waiting for the next move on the part of the London people. As a matter of fact it is hardly likely that the rails there will ever come into the scrap market, although they would be very acceptable. But for re-laying purposes they would bring a higher price than scrap, and it's money that will determine such a matter, as well as the need for rails, although they are of the 60 pound sort. In a mile of such track there would be about 100 tons of metal.

Prices on several lines of metals moved up this week. The lines affected are light copper, crucible copper, heavy and copper wire, new brass turnings and red brass turnings. The increase is one cent per pound. United States government has placed the price of No. 1 electrolytic copper from 23½ to 26c., and the prices of scrap are trailing along in the same direction. There is a tendency in some circles to buy heavy on copper in anticipation of further advances. Dealers are not anxious to strip their yards on this tendency until they see exactly what the future is going to hold for them in the way of restocking chances.

More Advances

There have been increases noted in many lines of metals during the week. All grades of copper are up. Lake copper and electro copper are quoted at 29½, and copper castings at 28½.

Tin still moves around the $1.25 mark. The tin market is a peculiar thing just now. United States government is taking some rather drastic steps in order to spread out the available supply of box tin. Certain canning factories are shut off while until late in the season, and it is not permissible to can certain brands of milk, as it is considered that there is a sufficient supply of this on hand to last for some time to come. High prices bring very few offerings to the market, and the fact that a certain figure is named is no indication that a sale has actually taken place at that point. Yet, notwithstanding all this, there are no concerns that we have heard of that are pinched hard in this country for a supply of tin. Prices are sky high and there's not much to be had, but it hasn't come to the point of real hardship yet.

Spelter advanced quite sharply also and is now on the list at 11c. Lead, antimony and aluminum are also among the prices to advance.

CONTROL OUTPUT OF MACHINERY NOW

U. S. Government Takes Another Step Towards Having Situation Well In Hand

Special to CANADIAN MACHINERY.

NEW YORK, July 10.—Greater control of the machinery industry is being taken by the Government, the latest phase being the reference of all orders for travelling cranes to the War Industries Board before final action may be taken. Representatives of crane builders in New York this week were notified that a decision had been reached by the Government to control the manufacture as well as the sale of travelling cranes. It will be recalled that a Government Committee at Washington already has supervision over all orders, prices, and priority shipments of locomotive cranes and it is expected that the same method will be used in dealing with travelling cranes and possibly with other conveying machinery.

As a result of this action the Bethlehem Shipbuilding Corporation has submitted the orders which it was about to distribute for 100 travelling hammer-head and tower whirley cranes to the War Industries Board, but it has placed large orders for fabricating machinery and for machine tools calling for the expenditure of several million dollars, which together with the cranes are to be installed at the Liberty ship plant at Alameda, Calif. The Bethlehem Corporation has also asked for bids on fifty machines to be installed in extensions now being made to its Sparrow's Point (Md.), shipyard.

Other large inquiries for conveying machinery are in the market including 94 hoists for the Johnstown plant of the Cambria Steel Co. For the Baltimore & Ohio Railroad locomotive shop at Cumberland, Md., the Westinghouse, Church, Kerr & Co. have bought more cranes, and are negotiating for machine tools and for fabricating machines. The Pennsylvania Railroad Co. is preparing to buy cranes and machine tools for a new locomotive shop at Marietta, Pa.

Several shipyards have either bought or are in the market for cranes including the Federal, the New York Ship and the Downey Shipbuilding Corporation. The Navy Department is inquiring in the

HE CAN'T SEE WHY MACHINE TOOL BUSINESS SHOULD SLUMP AFTER WAR

Dealers in machine tools and supplies are fond of discussing the chances of their business when peace is declared, and in the period immediately following the war. The most of the dealers are up to their necks in business at the present moment. This applies to jobbers as well as to the makers of tools.

"I can't see where the business is going to have much of a slump following the war," stated one well-known manufacturer recently. "When you look at the way the machinery has been run, at the way in which much of it has been thrown together, and then consider that a great deal of it is single-purpose machinery, you will see that I am right in the views I have on this matter.

"You must remember," he continued, "that there has been a tremendously big element of haste in all this war work, I don't say that the work has been slopped over, but I do contend that there has been such a rush for machinery that it has not been built up to the standard of other equipment turned out in normal times by the same shops. Then this one operation day and night plays the deuce with a machine. Put a lathe, say a turret lathe for instance, on rough turning for a long time, three shifts every twenty-four hours, and let it stay there, with all the wear, tear, pressure and grind right down the one channel, and you are going to have a machine that after a year or so is not going to do other work nicely for you. That is a point that others may dispute, but I am speaking from actual observation and experience in war plants since this war started. Then on top of that remember that a great deal of the equipment that goes into plants now is single-purpose machinery. When it gets through turning out the contract on munitions it is good only for the scrap market, unless some person gets busy in the meantime and scares up rumors of another war that will call for the production of shells. I can't see where the machine tool business is due for a slump after the war. It seems to me that there is going to be a great big demand for good machinery, and that this demand will extend to a great many lines that have been practically standing still since the outbreak of the war."

Philadelphia market for 58 lathes and another list has been issued for Charlestown, Mass., delivery.

Steel Bars Wanted

There is a very heavy demand for shell steel bars from the Government, especially for the sizes used in manufacture of 75 mm. gun projectiles, but most of the mills rolling shell bars have capacity sold over the next four or five months and some of the large rail mills which have been rolling shell bars are preparing to return to the manufacture of standard section rails for the Railroad Administration, which has called for practically 2,000,000 tons to be shipped this year. Two companies in the Philadelphia district are preparing to manufacture 8-inch semi-steel shells and have issued tentative inquiries for machine tools. The American Shell C., Paterson, N.J., has bought additional equipment to increase production of 75 mm. shells. The Kokomo Steel & Wire Co., Kokomo, Ind., having received a shell contract from the Government will spend $3,000,000 for new buildings and machinery to enable it to execute the contract.

The Western Cartridge Co., East Alton, Ill., is preparing to triple its production and will need additional equipment. The Otis Elevator Co., Chicago, has bought additional equipment for its plant where it is making recoil gun mechanisms, and the Four Lakes Ordnance Co., Madison, Wisconsin, is buying additional tools to increase production of guns.

Want Equipment

Several steel companies are in the market for additional equipment and one list of machine tools has been issued for a plant in the Shenango Valley, the Atlas Crucible Steel Co., Dunkirk, N.Y., has bought cranes and the Midvale Steel & Ordnance Co. is still negotiating for machinery for its new gun plant.

Under the auspices of the United States Shipping Board, the purchase of 52 acres of land has been made at Birmingham, Ala., upon which to erect a fabricating shop to serve shipyards in the South, especially those at Jacksonville, Fla., and Savannah, Ga. The steel plate will be furnished by the Bessemer and Fairfield mills.

THE PRODUCTION OF COAL CONTINUES TO DECLINE IN MARITIME PROVINCES

Special to CANADIAN MACHINERY.

SYDNEY, N.S., July 10.—A settlement of the wage dispute between the Nova Scotia Steel & Coal Company is announced, an agreement having been reached by the company granting a small increase in wages to the men who were not affected by the findings of the Royal Commission. The workmen of the Dominion Iron & Steel Company are also dissatisfied with the findings of the Commission, and the company has offered an increase to the higher paid men, which has not yet been accepted. Some of the more strongly organized unions, such as the bricklayers and moulders, are not satisfied with the increase offered, and are demanding wages and working conditions such as exist in urban centres in the United States and in Ontario. There is a tendency among the skilled trades to endeavor to introduce union rules and conditions, a tendency that is bound to come into conflict with the management of large operations employing a great number of men, such as steel works. In industrial operations of such magnitude and complexity it is difficult for the management to deal individually with all the specialized trades that are represented on the payroll, or to recognize any differentiation in worth or status among employees, whose activities, while they may differ in detail, are really part of one general manufacturing process. This phase of the labor question is bound to cause some friction sooner or later. It is not expected that any stoppage of work is likely to take place at any of the Nova Scotia steel plants at this time and it may be confidently anticipated that a general settlement of all outstanding labor questions will shortly be reached.

Coal Output Declines

The coal output continues to decline. For the first six months of 1918 the production has fallen off from the record of the first six months of 1917 by about 330,000 tons, and it is only too probable that by the end of the year the total output will be less than those of 1917 by almost half a million tons. At the same time it is hoped the rate of decline in the last half of 1918 will not be so rapid as it was during the last six months. That is the best that can be hoped for.

The same tendency is to be noted in the production of bituminous coal in the United States and in Great Britain, and to those who know the situation the problem of coal production is not the least among the problems that face the Allied leaders. If the coal production declines to a point where it restricts the output of munitions and the transport of troops, the gravity of the situation will appear in its true light, and things are approaching such a point. The hardships which may be inflicted on private consumers by a shortage of fuel in Winter appeal most strongly to the man in the street, and the efforts of the Fuel Administrator in the United States and the Fuel Controller in Canada have been directed towards the amelioration of the condition of the domestic consumer, both as to price and quantity. But the operation of war factories, the transport of men and supplies, and the general operation of the machinery of war depends entirely upon coal. If these activities are touched, then the private consumer will have to freeze,, if need be. because the grim actualities of war will compel that the needs of the army and the navy shall come before the requirements of the people at home. It is not pleasant to perform the work of an alarmist, but it is all too certain—whether the war continues or not—that there will be a shortage of coal throughout North America next Winter much more severe than was experienced last Winter.

The excavation of the site of the new plate mill at Sydney is proceeding vigorously.

TAKING MEASURES TO SAVE TIN PLATE

U. S. Has Stopped Supply to Bean Canners and to Condensed Milk Plants

Special to CANADIAN MACHINERY.

PITTSBURGH, July 10.—Practically all the steel produced is still going out against Government orders or against the preference schedule of the more essential purposes for which steel should be used at this time. Any steel that might remain after the priorities and preferences were satisfied would be available for general distribution, but only under permission granted by the Directorate of Steel Supply. That there will be such a surplus eventually is commonly believed, but not until the present rate of shipping steel to the war activities causes them to call for a reduction in their quotas. The object of the present regulations is to cause stocks to accumulate in connection with these activities, particularly shipbuilding and shell making.

While the control of steel shipments is very rigid as to its general scope and purpose, there are increasing evidences that the War Industries Board does not intend to permit the industries that are not accorded any preferential treatment by the present regulations to suffer any unnecessary hardship. It is intimated that there will be relaxations from time to time to permit important business to go ahead provided it does not interfere with the main object of winning the war. The immediate reference is to manufacturing consumers, in the less essential industries, who have some stocks of steel on hand, but require some additional sizes or descriptions of steel in order to utilize that on hand.

Stocks of Steel

The fact that steel has been decidedly scarce for nearly three years should not be taken as proof that there are no stocks in the hands of buyers at the present time, for as a matter of fact the reverse is the case in many instances if not in the majority. What has been called a "scarcity" of steel for more than two years has not been a famine, but rather a difficulty in securing prompt deliveries, and unusual delays in securing deliveries of some sizes or descriptions. The natural result of this condition has been to cause jobbers and manufacturing consumers, as a measure of protection, to seek to pile up stocks so that they would be safe from loss when there were delays. It was not so much a scarcity of steel for the immediate requirements of the buyers, but an inability to obtain as much as was desired. It is the testimony of an authority quite familiar with the position of jobbers that in the main they have to-day heavier stocks, in point of tonnage, than they had two years ago. and yet the jobbers have been urging the authorities to devise a system of preferential treatment for them, particularly along the line of enabling them to replace freely any steel that they sell for direct or indirect war purposes. Many cases are arising of manufacturing consumers who seek assurance of future supplies when it turns out that they have stocks to last them for some time still, frequently for a couple of months. By the time these buyers really need any considerable quantities of steel there may be a fair supply available for them, and as already indicated the Director of Steel Supply is likely to accord small tonnages of steel to those who already have a considerable tonnage, but need some extra steel in order to round out their stocks. In this connection the director is naturally influenced by the fact that this will enable business to go on, keep money in circulation, and produce profits out of which taxes can be paid.

Sales and Deliveries

There is an interesting difference in the interpretation of the regulations by some of the producers. The majority of producers interpret the regulations as applying to deliveries only, thus permitting sales to be made irrespective of the use to which the material would be put if delivered, there being of course no guarantee when the sale is made as to when delivery will occur, if ever. Other manufacturers insist that the regulations do not permit them to make sales except of material the delivery of which is provided for by the regulations. As to deliveries there is practically no difference of opinion, the regulations being quite well understood and being interpreted substantially alike by all interests. As a concrete illustration, the American Steel & Wire Company adheres to the policy announced in its recent circular, of accepting business freely from its regular customers for delivery whenever this becomes feasible. Very nearly all, if not all, of the independent wire producers adhere to the policy of not accepting business from ordinary commercial buyers who are not accorded any preference treatment in the matter of deliveries. They do not deny that matters may eventually so shape themselves that the deliveries will be possible, but they maintain that when all mills are filled for about three months to come there is no use in booking additional business at this time unless it is of the kind that is accorded preferential treatment.

More Tin Plate

For the purpose of conserving sugar the Food Administration has issued an order prohibiting the manufacture of condensed milk. Evaporated milk is not included as it does not involve the use of much if any sugar. There are large stocks of milk in existence and further accumulation is quite unnecessary. This procedure will release a considerable quantity of tin plate. Another order has been issued affecting the supply of tin plate, restricting the packing of dried beans until September 15. The can manufacturers are not permitted to supply cans to the industry until the date mentioned, and tin plate makers are not allowed to supply tin plate to the bean packers who make their cans. Special exceptions will be made in case of lots of beans showing so much moisture that they might not keep. It is estimated roughly that the two orders will release, for other purposes, about a million boxes of tin plate in the next two months, and some of this may be available for increasing exports over the provisions already made. The tin plate mills expect to produce regularly about three and a quarter million base boxes of tin plate a month during the remainder of the year, and this will bring the calendar year's output to fully 36,000,000 boxes. Arrangements were recently perfected whereby each tin plate plant will be fully supplied with steel. Each plant is rationed with so many tons per week per mill. The only weakness of the system, as viewed in the trade, is that the only proviso against an accumulation of steel at a plant that has lost time or has otherwise failed to consume steel at the scheduled rate is that the plant is expected to report any accumulations that may occur and some plants may neglect to make such reports.

STORAGE OF COAL

Some notes on the storage of coal with reference to the prevention of spontaneous combustion were given by Mr. John H. Anderson before the Institute of Marine Engineers, London.

The author said that his remarks were based in particular on experience gained with a heap containing just over 16,000 tons. The heap consisted entirely of small bituminous coal, of several kinds, washed and otherwise, some being of a character supposed to be dangerous for storing. Under these conditions extra care was exercised. Temperature readings were taken at 14 different places nearly every day, and occasionally also at the vent pipes, of which there were 50. Further, to find the hottest part, readings were taken at every foot from top to bottom at certain places. Previous experience indicated that the warmest place was between 6 ft. and 8ft. from the surface; hence 7ft. was established as a standard depth for temperature records. The temperature tubes were ¾ in. or 1 in. gas tubing, driven in from the top to the bottom of the coal and long enough to project 2 ft. or 3 ft. above it. In most cases the vent pipes were old scrap tubes about 8 ft. long and 3 in. or 4 in. in diameter, and were driven down to the 7 ft. mark, their ends being flattened, chisel-shape, to facilitate driving.

By taking periodical readings of the temperature of the pile and comparing them with previous readings ample warning was obtained to prevent a fire. If a readying of 90° F., which was adopted as a warning temperature, was obtained at any place four other temperature tubes were driven down north, south, east and west about 10 ft. from the warm tube. The tube which gave the highest reading next day was then made the centre, and other pipes put down in its direction, the idea being to locate the source of heating. When the warmest place was found an additional vent pipe would be put in there, and this generally arrested the rise of temperature. If, however, it did not, a trench was dug a foot deep on each occasion—that is if the readings remained at, say, 100° for three days the trench would be 3 ft. deep. In fact a temperature of 100° was never reached, but on four occasions, when 95° was recorded at a point where the coal was deposited to a depth of 16 ft., a trench was dug. Probably, however, this trenching would have been unnecessary had additional vent pipes been inserted. If a fire occurs, although plenty of water should be available to quench it, it is better to dig all round it, and if possible remove the hot coal.

In general the depth of the heap should not exceed 12 ft. to 14 ft. for small graded coals, or 9 ft. to 12 ft. for unwashed mixed coals. As regards slacks, a good deal depends on the composition. The author allowed two heaps of this material 10 ft. deep to rise to 120° before moving them, and they gave considerable trouble; even when they were reduced to 6 ft. there was a tendency for them to increase in temperature. Anything, such as pieces of wood, pit props, rags, waste, shavings, and straw, that ignites at a lower temperature than the fuel should be kept out of the heap. As a rule the greatest danger is up to about three months from the time the coal is taken out of the pit.

NEW POWER STATION AT GLASGOW

The total power capacity of the new electric power station now under construction at Glasgow, and to be opened next year, is 150,000 kilowatts or 200,000 horse-power. The central station is at Dalmarnock, and electricity will be transmitted at a pressure of 20,000 volts (three-phase alternating 25 periods per second) to distributing centres in other districts of the city.

A site measuring 13½ acres has been taken in hand bordering the River Clyde, and an ample supply of condensing water is obtained from that river. The first portion of the works already completed comprise a water intake, a screening house, two water culverts, switch house, turbine engine room, two boiler houses, workshop and store, and a complete coal-handling plant capable of dealing with 100 tons of coal per hour. The cost of this coal plant is £24,800.

The first instalment of the machinery will consist of three 15,000 kilowatts (20,000 horse-power) turbines, which will be coupled direct to alternating current generators; also three 1,000 kilowatt (1,300 horse-power) turbo sets for driving auxiliary machinery. It is proposed to add plant units of 15.000 kilowatts as the demand increases, while turbines of 30.000 kilowatts can be installed if found to be necessary.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

FINISHED IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	4 55
Steel bars, base, Montreal	4 50
Reinforcing bars, base	4 50
Steel hoops	7 50
Refined iron	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$31 00	$29 50
Electro copper	31 00	29 50
Castings, copper	30 00	28 50
Tin	110 00	125 00
Spelter	11 50	11 00
Lead	10 50	10 00
Antimony	15 50	18 00
Aluminum	50 00	58 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Effective Feb. 5, 1918.

	Black	Galvanized
Standard Buttweld		
Per 100 feet		
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 16	7 29
⅜ in.	5 16	7 29
½ in.	6 55	8 12
¾ in.	8 28	10 41
1 in.	12 24	15 39
1¼ in.	16 56	20 82
1½ in.	19 80	24 89
2 in.	26 64	33 49
2½ in.	42 72	53 53
3 in.	55 85	70 00
3½ in.	70 84	87 86
4 in.	83 93	104 10
Standard Lapweld		
2 in.	$ 29 60	$ 36 08
2½ in.	44 46	54 70
3 in.	58 14	71 53
3½ in.	72 68	90 62
4 in.	86 11	107 37
4½ in.	97 79	122 56
5 in.	114 00	142 82
6 in.	147 80	185 28
7 in.	192 80	241 57
8 L in.	202 50	253 75
8 in.	233 30	292 32
9 in.	279 50	350 18
10 L in.	259 20	324 80
10 in.	333 70	418 18

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES

4" and under, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$19 00	$20 00
Copper, crucible	22 50	23 50
Copper, heavy	22 50	23 50
Copper wire	22 50	23 00
No. 1 machine composition	22 00	21 50
New brass cuttings	16 00	15 00
Red brass turnings	18 00	18 00
Yellow brass turnings	12 50	12 50
Light brass	10 00	9 50
Medium brass	12 00	12 00
Heavy brass	15 00	14 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	34 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	26 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs	9 00	8 50
Cast borings	12 00	12 00
Stove plate	19 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	7 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 ... add	20
Machine screws, o. and fil. hd., brass ... add	25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ... plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws ... list plus	20
Collar screws ... list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ... add 40,	10
Cold pressed nuts to 1½ in. ... add	$4 50
Cold pressed nuts over 1½ in. .. add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 50
Solder, guaranteed	0 53
Babbitt metals	18 to 70
Soldering coppers, lb.	0 53
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	0 71
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	2 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular	0 12
Wood alcohol, per gallon	1 80
Whiting, plain, per 100 lbs.	2 20

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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..	$ 8 00	$ 8 00
Sheets, black, No. 10..	10 00	10 00
Canada plates, dull, 52 sheets	9 00	8 65
Can. plates, all bright.	9 50	9 50
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 20
Premier, 10¾ oz.	.....	9 50
Zinc sheets	20 00	20 00

PROOF COIL CHAIN B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	37½
Disston	50
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck..	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod..	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra..	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .22
Acid, hydrochloric	off
Acid, hydrofluoric	.09½
Acid, nitric	.10
Acid, sulphuric	.03½
Ammonia, aqua	.14¾
Ammonium carbonate	.20
Ammonium, chloride	.40
Ammonium hydrosulphuret	.50
Ammonium sulphate	.30
Arsenic, white	.25
Copper, carbonate, anhy	.45
Copper, sulphate	.17
Cobalt, sulphate	.90
Iron perchloride	.20
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.65
Nickel sulphate	.35
Potassium carbonate	1.50
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.75
Sodium bisulphite	.25
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.18
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.18
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.18

Prices per lb. unless otherwise stated.

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INDEX TO ADVERTISERS

Canadian Machinery and Manufacturing News

Volume XX No. 3

July 18, 1918

Some Considerations Regarding Modern Plant Organization--7

By M. H. POTTER

The factors which enter into the successful manufacturing business of to-day are interdependent to an ever-increasing degree. Location, type of building, transportation facilities, staff organization and plant equipment are features which require to be considered both singly and as a whole in relation to the particular product to be undertaken. A clear and concise idea of such considerations is necessary before entering any one line of manufacture.

CORRESPONDENCE

THE discussion of that most important phase of a business house's outside relations—its correspondence, falls under two heads: (1) Incoming mail and (2) outgoing mail.

1.—Incoming Mail

Every transaction handled by a business house, except cash sales, must sooner or later be dealt with by the correspondence department, and to facilitate and simplify the methods of conduct and of keeping records is the first aim in organizing this department. Above all, simplicity, combined with accuracy, is to be desired, as a system is useless in which a letter is filed away so elaborately or carelessly that it can never be found again.

The head of the department is responsible to the business manager. He has charge of the following duties, performed singly or in conjunction with persons under him:

1. Disposal of incoming mail.
2. Stenographic correspondence, etc.
3. Mailing.
4. Filing.

In a large business a central room or mailing department is the most satisfactory and convenient way of handling mail. Hence all incoming and outgoing mail should be received. Telegrams should be received and signed for in this department and delivered to the person or department for whom they are intended.

Treatment of Incoming Mail

The letter carrier should deliver to this department all the mail, taking receipts here for registered and special delivery letters and collecting postage due.

The mail should then be carefully sorted by the head clerk of this department or one of his assistants, the personal mail being separated from the company's. Personal letters are delivered unopened. Individual letters addressed conjointly to the firm are delivered to the head of the department in which the person is located. Letters of importance go to higher officials. Routine letters are passed on to the regular correspondents. The company's mail should be handed to one or more clerks to be opened, they in turn passing it to others to remove the contents. Clerks should be very careful to pin all enclosures to letters to which they belong. The mail is then passed on to others, who apply the receiving stamp. It is better to stamp all mail on the back to avoid disfiguring the face of the letter. When stamped the head clerk should note the department to which the letter belongs and place it in a basket or pigeon-hole of a case marked with the name of the department. When the mail is all sorted, according to departments, it is delivered by a boy to the respective departments. A convenient way to carry the mail is in a strong leather bag divided into compartments, marked with the name of each department.

If firms, when writing on different subjects, would write one letter on each subject and address it to the department in question, it would simplify the delivery of mail very much, and also insure its going direct to the department to whom it belongs. Much time would be saved in delivery and possibly misplacement or loss of letter avoided. Reference should be made to the person whose letter is being answered. Very often a letter merely addressed to the company will go the rounds of all the departments for a day or two before it is finally claimed by the person to whom it belongs.

The distributing of incoming mail should be, of course, in the hands of a thoroughly reliable person, familiar with the names of the persons connected with the company and the matter handled by the various departments.

To facilitate filing and also keep a clear memorandum, of the business on hand the clerk might note on small cards the business of each letter, the department or official to whom it is sent, or any other special remark. Such cards can be attached to their respective letters, and when returned in the evening would be endorsed with the action taken and then filed, furnishing a complete record of the transaction.

Personal Letters

Personal letters sent to employees in care of the firm, or business letters which are addressed to the employees individually, should be discouraged. In the first instance, such mail only clogs up the machinery of the office. In the second, important matters may be delayed on account of the absence of the person to whom sent. Many business houses now print above their stationery a request that letters pertaining to the business should always be addressed to the firm.

Stenographic Correspondence

After letters have been received, distributed, and read, they remain to be answered. In some cases the heads of the business have their own private secretaries, but the general bulk of the correspondence is undertaken by a staff of stenographers, under the supervision of a chief stenographer. It is usual to have the stenographers in a room separate from the rest of the office. Calls for stenographers are sent to the chief, who selects one of his staff according to the amount of work he or she has got at the moment, and so arranges that stenographers are not confined exclusively to the services of one department.

It is the duty of the chief stenographer to see that the mechanical qualities of the letters sent out are perfect; that care is given to spelling and punctuation, etc., and that the work is done promptly.

There are several ways of keeping supervision upon the work of individual stenographers. Probably the best is that in which the chief stenographer, in sending a stenographer to take letters, gives him or her a daily card, which is to be filled out with: (1) Stenographer's name; (2) dictator's name; (3) time of taking notes; (4) time of transcription; (5) number of letters. A duplicate is kept by the chief stenographer, who files it, and from that source can make up a weekly statement of work done by individuals. The stenographer in transcribing her notes makes carbon copies of all letters. The letters are sent to the proper department or person for signature, while the carbon copy is attached to the letter to which it is a reply and is ready for filing.

Filing

The object of filing is to keep an easily available record of correspondence, and it is important that it should be in the hands of careful operators. Filing may be done according to four methods—alphabetical, geographical, numerical, and by subjects—these having been generally accepted as the most efficient. Whatever system is employed, care should be taken that all folders and drawer files are of standard size. The letter is first placed in a folder, and the folders are put into vertical drawer files, the divisions or grades being of cardboard, the tabs on which are a trifle higher than those of the folders. Each folder should bear the name of the department to which the filed letter refers, and be filed in front of the guide for that division.

Alphabetical

When the correspondence is small, this is the most usual form. The guides are printed with the alphabet in sub-divisions. Firms with which a large correspondence is carried on should have a separate folder. In the alphabetical system the correspondence is filed alphabetically under the name of the correspondent. Though not absolutely necessary, an auxiliary card index will often be required in the alphabetical file also, particularly to locate letters signed by individuals, but filed under the names of the concerns whom they represent. Letters from infrequent correspondents go into a miscellaneous folder.

Geographical

The geographical system is adaptation of the simple alphabetical system of a very large business. In this system the primary divisions of the catalogue are geographical ones, usually the provinces. If desired, these are still further divided into cities. The matter is filed alphabetically under the names of the correspondents residing in each geographical section. In firms which have a large staff of salesmen on the road this method is to be preferred.

By Subjects

In the index by subjects all papers relating to a given subject, irrespective of the names of the correspondents, are filed together. This method is rather unusual, and only used by manufacturers or manufacturers' agents who make or distribute many varieties of articles. Here the guides bear the name of the articles, and the folders the names of the various materials. A cross index is usually necessary under this system, to make sure of finding a letter without difficulty.

Numerical

This method is usually resorted to by houses which have a large mail from regular correspondents, and is much used in advertising departments. In the numerical system each correspondent is assigned a number, under which all his correspondence and all papers relating to him are filed. In this case the guides are numbered by tens, increasing consecutively, the folders bearing unit numbers. One folder is given to each house, and in cases where the correspondence overflows additional folders bearing the same number may be filed alongside. As naturally the system of numbers gives no clue by itself to the names of the correspondents, there should be an accompanying card-index, the cards of which have the name of the firm, address and file number, with cross-reference cards, and in some instances another color for the individual members of the firm, both sets referring to the same folder.

The files should at all times be kept in perfect order, and no one should have access to them but the filing clerk or clerks. All letters should be removed only by such clerks, and should be returned promptly. To insure their return a memorandum should be placed in their stead in the file. Once or twice a year letters are transferred from the current files to stored filing cases. There should always be at least six months' correspondence in the current files.

Tickler File

When a letter is to be taken up or followed up at a specific future date two carbon copies are made, one of which is filed with the correspondent's letter, the other being placed on the tickler or reminder file, the guides of which are labeled according to date. The memory is thus jogged at the proper time and no small detail is forgotten. The file is kept in the ordinary filing department, but each correspondent has a desk file of his own covering the correspondence with which he is concerned. Letters to branches, which are frequently inquiries, should have a blank space thereon for replies, the original being used. When this is returned to the inquirers it is, therefore, complete and reference does not have to be made to the copy.

Outgoing Mail

Letter writing has always been one of the fine arts, but it is only within recent times that any attention has been paid to business correspondence. Although personal writing is being driven back by the telegraph, postcard, and telephone, letter writing in business is day by day being advanced to greater efficiency by the introduction of the personal element.

The Outer Form of a Letter

Business organization has this fatal faculty, that it conduces to mechanical adherence to certain well-established rules. The letters of one firm imitate those of another or of all until correspondence becomes a series of set phrases. Forms become stereotyped and language either too bald or too prolix. A letter may be written more or less vague on stationery which is an eyesore, clumsily crushed into an envelope half-opened and insufficiently addressed. It is allowed to leave the office not alone, but in the company of equally faulty mail matter. And the harassed head of the business, seeing the balances dwindling, wonders why, with the best salesmen, an organization almost perfect and goods all that he claims them to be, his rival outstrips him in the race. As a hint he might well look at the correspondence methods of his rival.

The company which prides itself on its standing will make a special feature of its letter writing, with careful attention to every detail of form, typing, and stationery. Nothing is too trivial to be overlooked. A man might as well go out to a reception with his clothes unbrushed as send out slipshod letters.

Letter-Heads

The letter should be engraved or lithographed. If type is used it should be simple and bold. Occasionally lettering may be printed from the line block. Bright colors should be avoided. It is better to use black. The trade mark may be introduced, but it is out of place. The letter should include:

1—The name of the individual or firm.
2—The address.
3—Department of issue to which replies are to be addressed.
4—Telephone number.

It might also display the names of the officers, cable address, foreign branches or agencies, and nature of business. But care should be taken not to create confusion by overloading. The less space used the better. Advertising should rarely be permitted to enter into a letter-head. It is not the proper place for it.

Printed Matter

Take a few minutes and glance over the stationery you are now using. Is it good printing? Does every letter, rule and other characters stand out clear and sharp? Or are the characters broken in places, with scarcely enough ink? Look on the back of your letter-heads, etc. Are the letters and rules piercing through, so that they can be plainly read from the back of the sheets? Are the sheets marked on the back with offset, or smeared with ink? If any of these defects are noticeable the work is not good enough. Insist on the use of some of the latest, clear-cut type faces. Where printed forms are used largely in the mechanical departments of a factory stock reports, time sheets, memo. blanks, etc., it is the experience of every business man that the heads of the departments frequently make use of the last sheets before ordering an additional supply. To prevent delay the printer should be instructed on receiving an order for the blanks to place in stock and hold until the next order two or three pads of one hundred sheets each of the work in question.

The business man can prevent considerable waste in printing by ordering all sheets, forms, blanks, etc., tablated in pads of one hundred sheets each. The sheets do not then become scattered or soiled, and are more conveniently handled in the mechanical departments.

Envelopes

The envelope should be printed in exact conformity with the accompanying letter. Thus if the name of the department appears in the enclosure it should appear on the front of the envelope also, in the left-hand corner. If delivery is not made, the envelope will thereupon be returned without delay to the proper quarter. A small matter, but one of the many which go toward making up a good impression, is the folding of the letter. The folding of the sheet should be carefully done, so that on opening the envelope the first thing to be seen is the firm name in the heading.

Typewritten Letters

Much depends upon the make-up of a letter. The type should not be smeary, and erasures should be avoided. Group your type lines symmetrically and even up your margins. If you have a short letter set it in the middle of the page. Don't crowd it up at the top. Indent your paragraphs, and if you want perfect clearness leave space between each.

Contents of a Letter

Every letter should contain six things:

1—Day, month, year.

2—Name and address of person to whom sent.

3—Opening salutation, sir, etc.

4—Body of the letter.

5—Complimentary ending, yours truly, etc.

6—Signature; if typed, followed by signature of official.

It has been said that the business letter, as representing an agent, should be couched in language as much like that of conversation as possible. This is not true. There are some simple requirements of a good letter which are entirely subservient to the individuality of the writer. Remember, first, that the letter should carry some of the personality of the writer. Know what you want to say before you begin, and say it in your letter in such a way that the reader can not fail to see its logic. Be brief, but not too abrupt. Don't eliminate everything that goes to make smooth reading, but don't try to tell too much.

Let your letter be grammatically correct, but don't be afraid to use expressions of every-day use. Keep clear of stereotyped forms. Regulate "yours of even date," "would say," etc.; discard them, and also omit "herewith," "please find enclosed," "the same" and "thanking you in advance."

Routine Letters

Purely routine letters have been greatly simplified in some offices by preparing in advance a series of form paragraphs, which are kept on file. With a series of these form paragraphs in front of him the writer can frequently dictate an entire letter by merely stating to the stenographer that she is to use form paragraphs No. 1, No. 4, etc., as the case may require. The great saving of time in this way is at once apparent.

Disposal of Outgoing Mail

All outgoing mail is in the hands of the outgoing mail clerk, or a staff of clerks under one head. Their duties are to see that the outoing mail is gathered and brought to the mail room, that it contains all the specified enclosures, and is properly stamped and mailed. Where large quantities of mail are to be sent out both time and clerk hire are economized by addressing and stamping machines.

The various stenographers should address their own envelopes and make their own enclosures; or some one else in the department must be made responsible for this work, in order that enclosures for letters shall be enclosed in their proper envelopes. Where an enclosure is to be inserted it is well to put the word "enclosure" at the bottom of the letter.

To get the mail off as promptly as possible a boy should be sent around to the different departments every hour to collect all that is ready to go out. The plant and branch mail may be allowed to accumulate until the time for sending it, a schedule for which may be obtained at the post office. Most of the mail of a large business house will come to the mail room at the close of the day. This can not always be avoided, but so far as possible mail should be sent to the mail room at more frequent intervals.

U. S. READJUST INDUSTRIES FRO WAR WORK

For the purpose of developing new industrial resources to meet the war demands of the Government, and quickly to disclose additional means of increasing production, the U. S. War Industries Board has just established a Resources and Conversion Section. Mr. Charles A. Otis, of Cleveland, former president of the Cleveland Chamber of Commerce and a member of the Board of Directors of the Chamber of Commerce of the United States, has been appointed Chief of this Section.

To carry out the plans of the War Industries Board, it has been decided to divide the country into twenty regional groups and to organize each region through the commercial organizations within the region.

In each of these regions all types of industry represented in the membership of the business organizations and in addition all industries which may not be a part of such membership will be invited to co-operate.

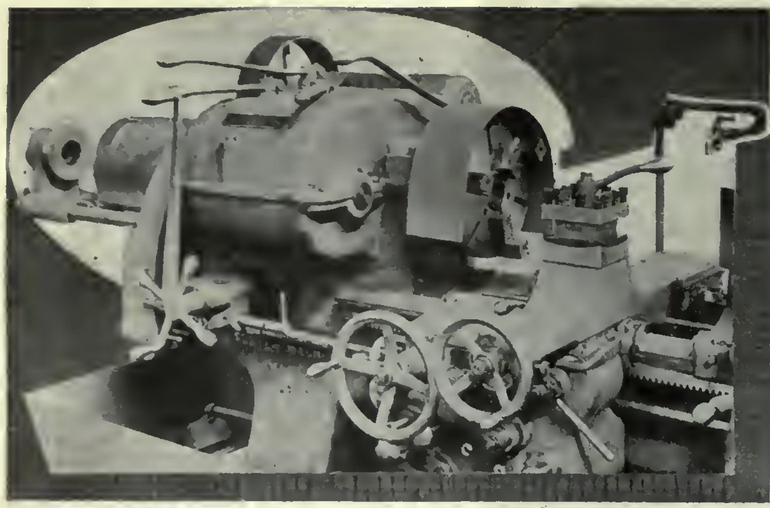
The purpose of this regional system is immediately to make a careful survey of every section of the country to determine what industries not now doing war work may be utilized for such work, and also to ascertain what industries already engaged on work for the Government are able to take on additional contracts or increase their production of munitions and war supplies.

SURFACE HARDENING BRONZE AND COPPER

In occasional instances it is desirable to harden the surface of copper and bronze, such things as dies being preferably so dealt with to enable them to withstand wear. This hardening is best done by alloying tin into the surface of the metal after the articles are finished, the process being as follows:—Metal which is machined all over—and not mere castings having the "skin" left on—is taken and all grease and dirt removed by well scouring with caustic potash or soda, rinsing in clean water and drying in non-resinous sawdust. The articles are then heated to a red heat and thinly coated with pure tin, and the heat continued for some minutes, when all excess of tin is wiped off with a piece of tow and the heat maintained until the tin left is absorbed, after which the articles are allowed to cool in the air. Or the articles can be thoroughly cleaned and have the surface thinly coated with tin in the usual way, using zinc chloride as a flux. The work must then be thoroughly washed in hot water to removed any excess of chloride of zinc, dried quickly, and then heated to redness in a muffle in which a reducing atmosphere is maintained, the process being complete as soon as the tin is absorbed. As the metals are somewhat tender at red heat, they should be kept on an iron plate or fire-clay tile during the period of heating. It is also possible to secure this kind of surface alloying with a blow-pipe flame, because absorption takes place at a red heat, as most persons using a copper soldering bit find out to their cost on occasion, and a "burnt" tinned soldering bit wants some hard work to file it up clean and fit for use for its proper purpose. The same principle is involved in "pyro-plating" on steel, in this case silver and gold leaf being used, and partly alloyed with the steel by heat in a close muffle.

THE SUCCESSFUL men are they who have worked while their neighbors' minds were vacant or occupied with passing trivialities, who have been acting while others have been wrestling with indecision. They are the men who have tried to read all that has been written about their craft; who have learned from the masters and fellow-craftsmen of experience, and profited thereby; who have gone about with their eyes open, noting the good points of other men's work, and considered how they might do it better. Thus they have carried themselves above mediocrity, and in striving to do things the best they could, have educated themselves in the truest manner.—Santa Fe Magazine.

TO BRONZE cast iron thoroughly cleanse the metal and rub it smooth. Apply evenly a coat of sweet or olive oil and heat the iron, being careful that the temperature does not rise high enough to burn the oil. Just as the oil is about to decompose, the cast iron will absorb oxygen, and this forms upon the surface a brown oxide skin which holds securely, and is so hard that it will admit of a high polish.



Combination Turret Lathe for Bar and Chucking Work

By Oskar Kylin

CURRENT events with their ever-increasing demands on the machine shop resources of theh world, both in equipment and labor, have resulted in widespread use of machine tools which enable semi-skilled labor to rapidly produce work of high accuracy.

Turret lathes in particular occupy a prominent place in the category of labor-saving tools influenced thuswise, and a recent example of this class of machine is described herewith. It is now being built by the Foster Machine Co., Elkhart, Ind., and is designated No. 2-B universal turret lathe, possessing combined features for both bar and chucking work.

This turret lathe is designed to handle bar work up to 3¼ in. in diameter and 30 in. in length, and chucking work up to 13 in. in diameter. It is possible, however, due to the larger swing over the horns of the carriage to handle lighter chucking work up to 20 in. in diameter. As shall be noted more in detail below, the designer claims for this machine the distinction of being the most universal machine of its class on the market today. This claim is based on several peculiar features of construction, the exceeding wide and well-balanced speed and feed ranges and the numerous standard, semi-standard and special tools and attachments with which the machine can be equipped. These features have made the machine capable of handling economically work of widely different nature and quantity covering a range of work from small lots of one-half dozen or less pieces up to work in large quantities where the machine is running continuously for months on one and the same job.

Head and Bed

Fig. 2 shows an interior view of the head with the head cover removed and the gears exposed. The twelve feed changes ranging from 12 to 325 r.p.m. are obtainable by means of sliding gears. The levers for operating these sliding gear clusters are mounted conveniently on the top of the head cover as shown in Fig. 1. The start, stop and reverse friction clutch is mounted on the back gear shaft and operated by the lever shown directly over the front spindle box.

The machine is driven by a 4 in. wide belt on a 15 in. diameter pulley, the speed of which pulley for high-speed cutting tools is 500 r.p.m. For stellite cutters when a higher cutting speed is required a pulley speed of up to 750 r.p.m. is recommended.

The belt running at a speed of 1,960 feet per minute is capable of delivering to the machine up to 8½ h.p., which corresponds to a torque at the spindle nose of 43,000 inch pounds, at a spindle speed of 12 r.p.m. The reason for this seemingly excessive power of the head is that this machine is frequently called upon to take up to 4 or 5 cuts simultaneously at a comparatively coarse feed which the machine is easily capable of doing. The friction clutch is capable of pulling a load equal to about twice the power delivered by the belt. The gears throughout the head are of the Fellows stub tooth standard, advantages of which are added strength and smoother, quieter action. All the sliding gear clusters and the gears engaging same are carbonized and heat treated.

The gears run in an oil bath and the bearings throughout the head are automatically lubricated by means of the splash from the gears.

The bed is very liberally dimensioned and heavily ribbed internally which makes same capable or resisting exceedingly heavy cutting strains without the slightest tremor or deflection.

Square Turret, Cross Slide and Carriage

The cross slide carriage which bridges and travels on the two very liberally dimensioned ways of the bed is shown clearly in title cut. The rear end of the cross slide is built in the shape of a table on which standard or special tool holders, such as required to carry wide forming tools or multiple necking tools can be mounted. The square turret mounted on the cross slide is indexed and bound by means of the lever handle mounted on the top of same. The lock-bolt which is of the cylindrical vertically-mounted type is located directly underneath the working position of the cutting tool.

Fig. 4 shows a view of the rear half of the carriage apron with gears and drop-off lever in place. The sliding gear clusters and the gears engaging same are made of chrome nickel steel. The gear tooth form is that of the Fellows' stub tooth standard. The lower gears in the apron run in an oil bath and all

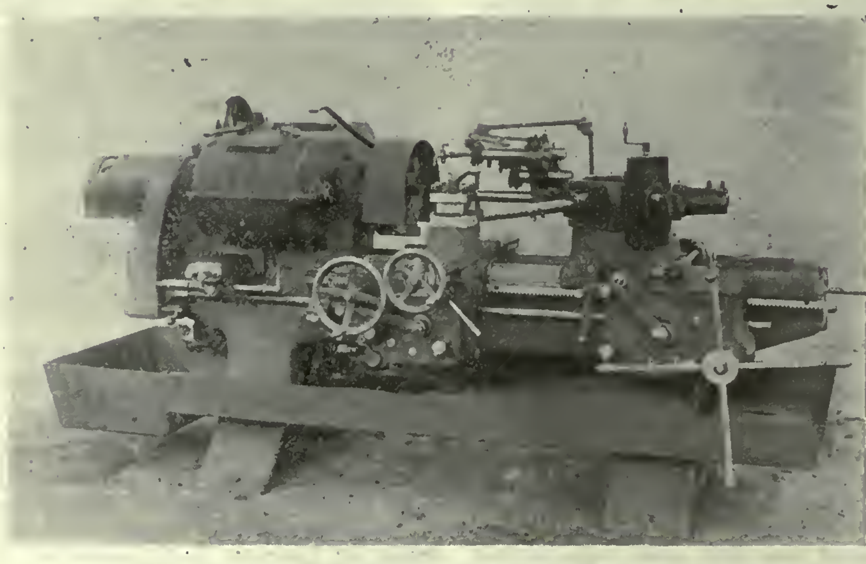


FIG. 1—UNIVERSAL TURRET LATHE WITH CHUCKING EQUIPMENT

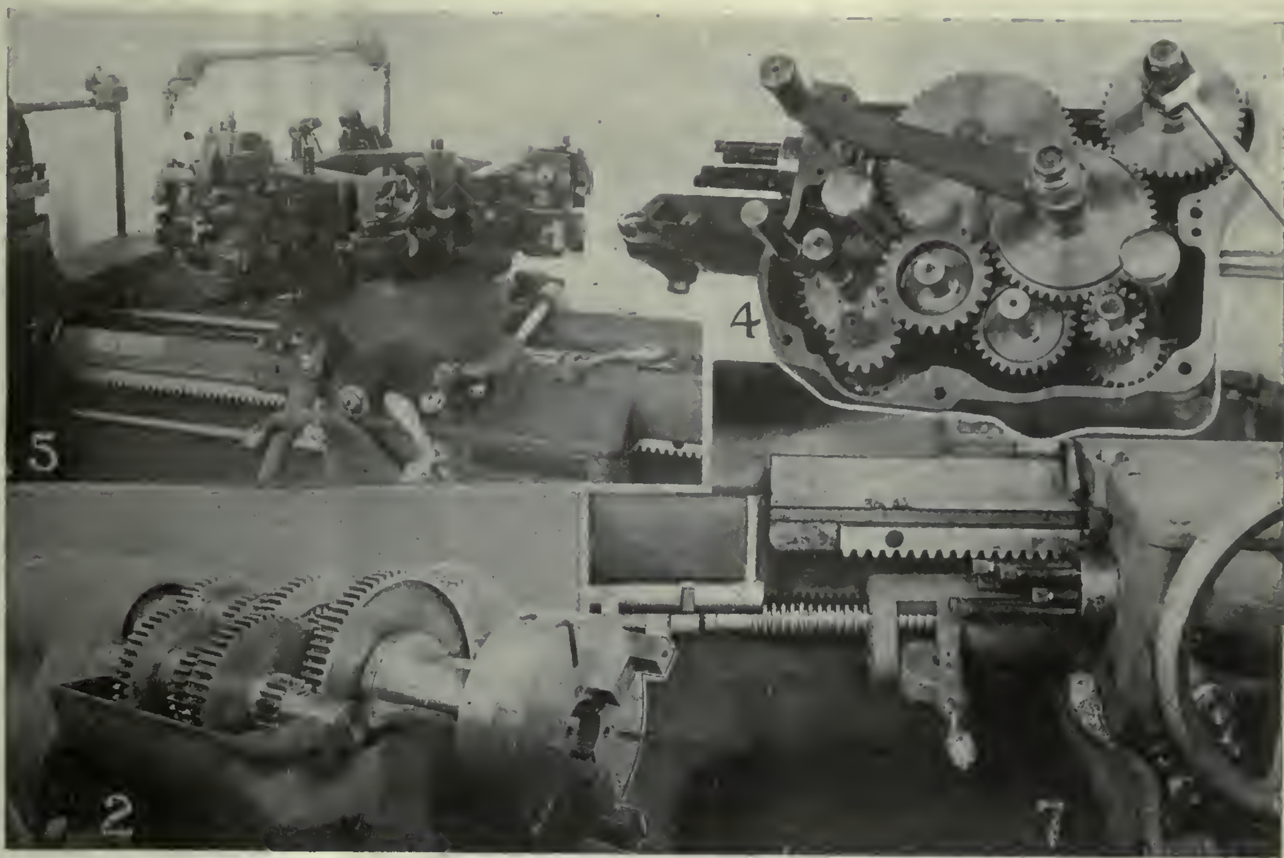


FIG. 2—VIEW OF HEAD WITH COVER REMOVED, SHOWING GEARS; FIG. 4—REAR HALF OF CARRIAGE APRON WITH GEARS AND SHAFT IN PACLE; FIF. 5—HEXAGON HEAD AND SADDLE WITH BAR TOOLS IN PLACE; FIG. 7—VIEW SHOWING SCREW-CUTTING ATTACHMENT AND CARRIAGE STOP

the lower bearings in same are automatically lubricated.

For the longitudinal gauging and duplicating of the work the carriage apron is equipped with six independent adjustable stop screws mounted in an indexable stop spool and abutting in turn a sliding stop rod mounted in a bracket secured to the bed. This butting of the stop screw against the stop rod causes the drop-off lever to drop and thus disengage the feed friction. The advantage of a drop-out feed friction above that of a drop-out worm is obvious, being that of instantaneous engagement. For duplicating and gauging diameters of the work, a large diameter dial is mounted on the cross-feed screw, which dial has in turn on same, adjustable observation stops. The cross-feed is disengaged by means of the short lever shown pointing to the right on the carriage apron.

The twelve feed changes range for the longitudinal feed from .0055 in. to .150 in. per spindle revolution and for the cross feed from .0029 in. to .080 per spindle revolution. Six of these feed changes and the reverse for same are obtainable by means of the sliding gears in the apron, which changes are multiplied by two changes obtainable in the gear box at the head end of the bed and which changes give two speeds to the feed rod.

Hexagon Turret and Saddle

The main turret which is of the hollow hexagon type and very liberally proportioned, is shown in Fig. 5 with bar tools mounted on same. The turret saddle which has an exceptionally long bearing on the bed has mounted on same, an apron very similar in design to that illustrated and described above for the carriage. The drop-off feed friction which is automatically disengaged in a manner similar to that operating the feed friction for the carriage apron is here controlled by stops adjustably mounted on a long stop roll located between the ways of the bed. This stop roll is long enough to take care of work up to the maximum length capacity of the machine.

The saddle is equipped with quick traverse which is operated by means of a lever mounted on the front side of the saddle and shown in Fig. 5. The quick traverse mechanism itself is illustrated clearly in Fig. 6, being mounted on the rear side of the saddle. It consists of a right and left hand screw with nuts which are intermittently locked by means of a double friction controlled by the lever on the front side of the saddle as mentioned above. A rod adjustably

FIG. 6—REAR VIEW OF 2-B UNIVERSAL TURRET LATHE WITH AUTOMATIC CHUCK AND MOTOR DRIVE

mounted in a bracket secured to the rear end of the bed automatically disengages the quick traverse and thus limits the rearward movement of the saddle. The quick traverse screw which is fully protected from chips and dirt by means of the telescoping tube is driven by a bolt from the main driving pulley.

Automatic Chuck and Bar Feed

The automatic chuck which is of the standard collect type construction is shown in Fig. 6. The main point of interest in connection with same is the short overhang of the end of the automatic chuck beyond the front spindle bearing. A new lever action for operating the automatic chuck wedge has been introduced and has proven to facilitate greatly the ease of operating the automatic chuck and increased the gripping power of same. The bar feed head travels on two parallel bars, the outer ends of which are supported in a rigid stand.

Attachments

As has already been mentioned, the machine can be equipped with screw-cutting and taper attachments. The screw-cutting attachment, which is of the leader and follower type, can be seen clearly in Fig. 7. The leader, which is mounted on the main feed rod, is capable of cutting two pitches of threads in the multiples of one and four of that of the pitch of the leader. The follower is mounted in a lever in a projection of the carriage apron.

The taper attachment which is of exceedingly rigid construction is mounted on the rear end of the carriage and operates directly on the cross-feed nut. Same is very simple in design and can be seen clearly in Fig. 6.

Standard Tool Equipments

Very extensive and complete tool equipments for both bar and chucking work are designed for this machine. Fig. 1 shows the machine with a few of the chucking tools mounted on the hexagon turret but this illustration can only give a faint idea of the real merits of same and the extent to which the designer has studied and solved the problem of standard tools. Fig. 5 shows a view of the most commonly used bar tools.

General

The machine can be driven either from a countershaft or by means of an individual motor which is usually mounted on the front leg in a manner shown clearly in Fig. 5.

The system of supplying coolant in abundant quantity to the cutting tools has been thoroughly studied and is also shown clearly in Fig. 6.

The machine weighs, complete with automatic chuck and bar feed but without standard tools, 5,200 pounds.

CREATING THE REAL-MAN TYPE

By James E. Cooley

WE, who are part of the great planetary system, and who occupy a small patch on this hemisphere, need to undergo a reconstruction; a change tremendously broadening, before we can boast of greatness and civilization outvying that of historic time. We need to bury our prejudices, our weaknesses to overcome helplessness, and to undergo a rebuilding, in order to become a stronger race of men and women

We need to make a few radical moves and do things almost the other way round from what we are in the habit of doing them. Our high order of intelligence is far below what we would have posterity think it is. It has little of the summit-height, the cloud-altitude upreach; and we are not as yet a race of "high-brows."

We are sadly lacking in dash and spirit. No evolutionary period confronts us. We are still too languorously hide-bound to beds of ease and stolid indifference. Our growth is too slow. We still are lacking in the power of constructive thinking and acting, too deeply absorbed in things that are of little or no permanent value to us. Being such, we are sadly neglecting that, which might lead to our higher welfare, to a higher progressive state of existence.

There are a thousand and one details in life that demand our present attention; and one is as fully important as the other. It becomes us to know what each of these are. It becomes us to know how each of these needs handling. And it becomes us to tackle them vigorously and with our greatest energy.

The proper and necessary step to take to start us moving towards a higher progressive plane is first, to get the right perspective, and then to plunge ahead. If debris and refuse adorn your premises, if your home or factory and their contents are in upheaval and disorder, clean and straighten these up. Have a place for everything, and everything in it's proper place. Straighten and clean up your person. Keep your body clean, your nails evenly pared and manicured. Have your clothes spick and span. Keep the soles of your shoes well shod, your worn-over heels trim and smooth. Keep in condition always. Do not neglect the least little thing, nor do these things at spasmodic intervals. Be regular, erect, and strictly attentive. "Get the habit" and get it strongly.

If you proceed in this course, others will follow you in their turn. You will have begun to do your work better. You will feel better. Your spirit will become more animated, to move with greater forwardness. In this line of "culture" the ground plan of a progressive state will have been laid. A thousand and one improvements are bound to spring up on this. Men like yourself will strive more fervently. The study of medicines, the arts, and invention, will take on a new encouragement. Diseases, such as cancer, the "great-white plague," will be overcome; or each new disease or epidemic will be checked as soon as it appears. Childhood will get its full growth. Infant mortality will be a thing of the past. And new scientific discoveries will be the order of the day.

But we must first understand that it behooves us to wake from our indifference and indolence and take energetic measures and direct our efforts only in those things most useful and progressive. Putting down what hinders; purifying what is unclean, and making habitable and healthy all places wherein mankind works and dwells.

It is only as we work ourselves up and have that filled-with-vivacity promptness; that filled-with-battle-spirit-and-plunge go; that clear-as-a-crystal positiveness that we shall make any noticeable headway in whatever we try to attempt. But having these, developing them to the fullest, we are on safe ground to go ahead in trying to do something useful and big.

Again we may repeat, it is only when we get the right perspective, sense the need or needlessness of things, and face them squarely, and work indefatigably, that we are going to overcome the ills, the menaces, and inconveniences that man is heir to. It is only as we create the real man type—the man with a constructive mind—with the broad and higher outlook on things and affairs. Sweeping, where it needs brushing, digging up what should be removed.

The difference between this type and the present one is the difference between one who is confident and self-assertive, from one who is hesitant and vacillating; or the difference between a being having an unbreakable vertebrae, a stiff back-bone, from one who is hopelessly spineless. The man who uses his brain, who is sure-footed and forward, has the upper-hand on himself and his work and lacks nothing. Behind him, his confidence is his own fortress; ahead of him, his self-assertiveness is his field of great human endeavor.

Over the vast assemblage with with this earth is peopled, one must look long to find the very few if any of this type. It becomes us therefore, to create them. First, beginning with our own personal selves, and then enthusing others to become supreme and foremost, to do a man's part, and act a man's part. Where scenes and environments require changing, where trackless fields and deserts are still untrod, where seas and worlds remain undiscovered, there is our work ahead, there is our right task, our rightful inheritance.

If you have become this real-man type, that looks eagerly forward with a hopeful view, a broader outlook on each coming morrow, if you have become fully aroused out of a stone-hard stupor, if you have developed your strength, your unobscurable powers of scrutiny to see the grand possibilities of destroying the evils and errors of life, creating anew what is antiquated, if you have become a sound vigilant body, clothed with mightiness and greatness, all then that you do, all that you attempt to do, you will not only add to your glorification but you will stand out as an incomparable real, live, active human being, a credit to your race and time.—

Corrosion of Iron and Steel, and Its Prevention--VI.

By Abe Winters

Perhaps the most pathetic feature of man's existence on this planet is illustrated by the contrast between the immense metallurgical and manufacturing industries based on iron ore, and the loss of finished metal due to corrosion. Sometimes obscure, sometimes prominently noticeable, the ravages of rust are the most relentless of all handicaps which man lives under, undoing with hitherto unpreventable certainty that which he has done.

FARADAY'S law of the corrosion of metal in weak acidulated solutions and electrical energy applied to the anode is 1.0448 grains of iron per square foot per ampere hour. The film formed over the surface of iron or steel by the process under consideration is an insulating film, the insulating properties of the film render the processed metal impervious to galvanic currents or electrolytic corrosion as long as the film is intact at every joint. Hydrated rust carries over 20 per cent. of moisture, and so long as it can attack a fresh surface of iron and cast off the thin film of oxide as it forms it will release enough oxygen to begin another cycle of action. A pin scratch on a phosphorized steel surface will be sufficient to allow corrosion to begin and eventually destroy the entire article. Tests made under our personal supervision verify this statement.

Rust which forms on iron or steel is hygroscopic and carries 24 per cent. of moisture as it forms. This moisture never dries out under any atmospheric heat conditions, but is ever ready for a chemical decomposition; the hydrated red rust being nearly twice the volume of the iron from which it is formed, adds its efforts to the free hydrogen to push through the phosphate film and eventually create havoc over the entire surface. This mechanical action is far more energetic than mere casual observation would lead one to imagine. A very important requisite of rust-proofing coatings is a galvanic property to protect the underlying iron which may become exposed by scratches or pinholes. This property is totally absent in coatings produced in phosphorous-manganese solutions by simple immersion. The coating is non-metallic and the temperature at which the solution (212° Fahr) does not influence the structure of the metal surface or expand the pores of steel sufficiently to permit a penetration exceeding .001 inch.

Properties of an Ideal Rust Preventative

An ideal protective coating should be completely resistant, not only to chemical corrosive agencies but should be hard and tough to resist mechanical wear or abrasion. It should be capable of protecting the underlying metal by galvanic action. All rust-proofing films formed in acidulated solutions containing manganese dioxide, calcium or ferric oxides, do not possess properties conducive to automatic galvanic protection, furthermore these solutions are more expensive to operate commercially than the average manufacturer would expect after only a partial investigation of the process. It is not the intention of the writer to absolutely condemn phosphorous-manganese rust-proofing for iron and steel, the process has many very excellent features and is by no means totally ineffective or unscientific. The phosphate coating is more resistive to atmospheric influences than is generally admitted. If the coating is further protected by oil, wax or paint the results are often very satisfactory. Responsible authorities agree that for many purposes, particularly on small wares, the phosphate process is efficient and may be used commercially at reasonable cost. The excessive costs are usually the result of high chemical expense and unnecessary waste.

Group No. 4

In this group we have several metals which are electro-positive to iron, which would give us the desired result; some of these are antimony, arsenic, potassium, sodium or zinc, but about the only practical or commercial metal in the class is zinc. Zinc is a peculiar metal of pronounced characteristics. It is relatively low in malleability, ductility, tenacity and infusibility when compared with other metals. Zinc has a melting point of 419 degrees C., and under atmospheric pressure a boiling point of 918 degrees C. On this basis of silver at 100, zinc has an electrical conductivity of 29 and a heat conductivity of 36. It is practically non-corrosive in the atmosphere, a thin protective coating of carbonate of zinc forming upon it. Zinc is one of the highest electro positive metals, it having a potential of 0.493 volts.

Hot galvanizing, or the application of molten zinc to a metal is a commonly known process. The quality of the coating depends not only upon the size and nature of the article but also to a large extent upon the skill of the operator, who must use care and give constant attention to the work.

Cold galvanizing or electro-plating is the process of depositing a coating of zinc upon the metal to be protected by means of an electric current and an electrolyte. For many purposes cold galvanizing has proven particularly efficient, but, has never been regarded as a practical rust-proofing process for use on wares which are subjected to unusual corrosive influences or ordinary abrasive action resulting from natural causes. There are several very simple formulas for acid zinc plating solutions, these being more generally employed. Cyanide zinc plating solutions are to be preferred for some purposes, but the maintenance cost of cyanide solutions is an important consideration in commercial practice.

Sherardizing

The Sherardizing process of coating iron and steel with a rust-proof film of zinc was discovered in an accidental manner by Mr. Cowper Cowles of London, England, but is not essentially a modern idea as a process practically the same was known in prehistoric times; it, however, was used for a different purpose. Copper tools, vessels, etc., were placed in the ground in certain localities and kept hot by fires built over the spot, on removal the copper was found to have acquired a light yellow color and become harder. This was really dry galvanizing although an alloying of the two metals was not recognized. In Greek history Aristotle records the "bleaching of copper" by the same method.

Sherardizing is to-day a patented process but is without doubt the most effective rust-proofing process known for general purposes. Naturally there are many cases where the requirements favor such processes as the application of vitrified enamel, phosphate films or hot galvanizing, but for the majority of modern commercial needs the treatment of iron and steel by the electro-Sherardizing process is the acme of perfection for the production of protective coatings. Samuel Trood has refined the process of Sherardizing as follows: A process of sublimation, occlusion and adhesion, when considered in connection with the theory of ions. The process of passing directly from the solid state to the gaseous state and from the gaseous state direct to the solid state, in both cases stepping over the liquid state, is called sublimation.

Zinc as a solid may change into vapor without passing into the liquid state. For an exact definition of the physical condition of a body a knowledge of the values of all its variable properties is required. The three most important of these are temperature, pressure and volume occupied by unit mass of the substonce. It is a well known fact that the common metals are extremely porous. This is visible under a high power magnifying glass, as well as readily demonstrated by certain physical experiments. The condition of the metal may be graphically described as resembling a sponge soaked with water.

Occlusion

When a porous solid is easily permeated by a gas and condensation on the surface of the pores of the solid takes place it is called occlusion. An example of this may be seen in the absorption of 90 volumes of ammonia in one volume of charcoal. Nearly all metals absorb gases and, being heated, will allow them to pass through readily. An example of this is the fact that hydrogen will pass through heated iron. When a gas is in contact with a solid there are molecular forces drawing the particles together and this produces a surface condensation of gas on the solid. An example of this is the frosting of window panes in irregular figures. There also appears to be an electrical condition accompanying the evolution of gases from a metal inasmuch as the evolved gases usually contain a number of free ions. Naturally the exposed surface of the metal is the only portion which actively takes part in evolving gases so that the larger the area of surface exposed the greater the evolution of gas, other conditions being equal.

To be continued

BIG U. S. FIRM'S CAMPAIGN FOR LIBERTY LOAN

Final reports of the Liberty Loan Campaign among employees of the Westinghouse Electric & Mfg. Company and its subsidiaries show that the total subscription was $2,601,000. Of this, $2,217,000 was taken by employees of the parent company. Three subsidiaries showed 100 per cent. of employees subscribing—the R. D. Nuttall Company, the Krantz Mfg. Company and the Pittsburgh Meter Company. In addition to this, the Krantz employees subscribed the largest per cent. of the total payroll—10.4 per cent. and the largest amount per subscriber $87.27. Electric Company employees to the number of 32,048 subscribed $69.18 per capita, 5.2 per cent. of the payroll. All figures show a gratifying increase over those of the second loan, showing that Westinghouse men and women are solidly backing their four thousand fellow workers now with the colors.

THE KAISER'S EFFIGY

As might be expected in a company employing over 30,000 people, comparable to a good-sized city, the third Liberty Loan Campaign possessed some unusual features.

MEETING HELD DURING THE PROGRESS OF THE LIBERTY LOAN CAMPAIGN.

In order to cover the entire works thoroughly from office boy to executive, team captains were appointed who in turn selected their lieutenants and teams. The members of these teams sold every employee a bond, or got a very satisfactory reason for the refusal.

In one instance, when a widow woman, the sole support of several children, felt that she simply could not afford the purchase of a bond, the women employees of her section chipped in and secured one for her, every woman contributing.

Speaking of the part the girls played in the campaign, it is interesting to note that the telephone and sales records departments, composed practically altogether of girls, were among the 100 per cent. departments, that is, every employee a bond owner.

Considerable enthusiam was aroused among the workers by the appearance during the campaign, of Sousa's Great Lakes' Marine Band, that gave a concert in one of the large aisles of the works, and was cheered to the echo by thousands of Westinghouse employees who gathered to listen.

Considerable amusement was afforded on this occasion by the appearance of a grotesque effigy of the Kaiser, which was hung in full view of the large crowd. This likeness was built by some of the employees out of nearby materials and clothed in old discarded rainment.

SO MANY new problems face naval designers and marine engineers to-day that it is well to note with exactness the advances which have been made in mechanical efficiency, and the notorious shortcomings for which modern engineering is seeking a remedy. Even the scheme of standardized ships, does not claim any advantage beyond that of economy in building a number of vessels of identical type, so that the engineer cannot expect from the reproduction of familiar experience implied in such a scheme any help in overcoming the problems of engine equipment, boiler designs, propeller eccentricities, skin resistance, fuel economy and so on.

The engine room of any ship generates enough engineering questions to provide societies with ample material for discussion. From the voluminous discussions which have taken place, it is possible to ascertain the status of the Diesel engines, none of which, by the way, resemble the original productions of Diesel, the nominal inventor of them. The marine Diesel is bound to undergo changes before it becomes an all-round proposition, and it is to this that many engineers are devoting themselves at the present moment. The possibilities of application to war vessels can be stated briefly. Modern destroyers and light cruisers, as a rule, are propelled by means of high-speed turbines, supplied with steam by water-tube boilers of large power per unit and generally oil-fired. Speed being the great essential for such vessels, lightness and compactness of machinery are vital. Such steam-propelling machinery with auxiliaries will weigh from 27 lb. to 35 lb. per shaft H.P. The lightest Diesel engines weigh (without the auxiliaries) about 56 lb. per B.H.P. and consume, say, about ½ lb. of fuel per B.H.P., whereas steam turbine installations with auxiliaries, weigh about half as much per S.H.P., the consumption of oil fuel being rather under 1 lb. per B.H.P.

FROM THE MEN WHO PRODUCE

Methods, Machining Devices, Systems and Suggestions From Shop And Drafting Room

THE CAUSE OF BROKEN CRANKSHAFTS

By Maurice M. Clement

THE breaking of the crankshaft in the engine is a more common occurrence than is generally supposed It is often a break that only can be repaired by supplying a new shaft; there is at times a great deal of contention on the part of the owner of the engine in trying to establish a flaw in the material, whether one really exists or not. In many of these cases the claims of defect are well founded when superficial appearances only are considered; I am not far wrong in saying that in 70 per cent., of broken cranks the break shows that at least a portion of the shaft's diameter has been parted for some time, in other words, the separated points indicate an old break for from one-half to two-thirds the diameter of the shaft or less.

Only the remainder of the diameter shows a fresh break. The parts showing an old break often have the appearance of never having been united; with this condition of affairs an owner of a shaft is apparently justified in laying claim to a defect, and his claim should receive every consideration that justice and fairness demands, but the real condition that leads up to and causes the break should not be lost sight of; in the large majority of cases we can feel sure broken shafts are the result of loose journal boxes. It is not an uncommon thing to see an engine in operation that shows the crank shaft jumping in one or both journal boxes at each impulse the piston receives.

It is a matter that may have been noticed by the operator and lightly regarded; in his opinion it is only a trivial matter. Oftentimes this loose condition of the boxes entirely escapes the notice of the operator. But it is not a difficult matter to see how loose boxes may result in broken shafts; in the first place, we must consider the heavy flywheels that are carried on the gas engine shaft, these heavy wheels are quite necessary on a moderate speed engine of the single cylinder type to get the best results in power development, steady speed and fuel consumption. If properly carried by the shaft they are really an aid to its long life rather than a detriment.

Broken crank shafts would in my opinion be a very uncommon thing, if the journal boxes and wrist boxes were more carefully looked after and kept properly adjusted. The intent of a box or a number of boxes carrying a revolving shaft is to keep the shaft in perfect line at all times. A box cannot accomplish its purpose on a gas engine if it is not carefully and snugly adjusted all of the time. The sudden force applied to the piston of the gas engine and through it and the connecting rod to the crank shaft tends to lift the shaft out of its journal box bed at each impulse, even with the weight of the heavy flywheels crowding it constantly downward into its bed. If the boxes are snugly fitted, this lifting motion cannot occur, but, on the other hand, if the box caps are loose, each impulse raises the shaft and wheels, and as soon as the force of the impulse subsides the weight of the wheels and shaft bring it down into its bed again with a thump.

Now if only one journal box is loose and the other one is properly adjusted, the lose end of the shaft only will jump, throwing the shaft out of line at each impulse; this condition may be regarded as even worse than where both boxes are loose, now add to the loose box or boxes the weight of the belt and drive pulley on the shaft and the cause for a great many breaks can be easily explained.

As before intimated, a shaft seldom breaks all at once. The condition that really causes the break has been in existence and started the trouble a long time before the final complete rupture comes; there is an unintentional and undue strain on the shaft every time it jumps in the boxes, this continual heavy strain at regular intervals soon causes what is known as crystallized condition of the metal in that part of the shaft where the greater strain occurs.

The crystallizing of the metal destroys the tensile strength of it, and it becomes fragile, usually this crystallized condition begins at a point on the outer circumference of the shaft and travels toward the center. It does not necessarily, and in fact not generally, affect the entire circumference. A third or half of the circumference only is the rule. At this fragile point a crack is started by reason of the continued jumping of the shaft in its bearings; as the crystallized condition grows the crack grows deeper until finally the good metal remaining is no longer able to withstand the strain and breaks in two; when the broken ends are now examined, the fresh break shows only so far as the good or adhesive metal held on. The original crack may have been started weeks or months before, and the constant motion caused the broken parts to rub together until they often appear as if they have never been united.

Many times the owner of the engine uses the expression, "that was never welded properly," or "the shaft was only partly welded." The common opinion or supposition among many engine owners that crank shafts are welded together is illfounded. Cranks are generally made by either the drop forging or steel casting process. No welding process whatever enters into their formation. Another process of making crank shafts is cutting them out of solid steel billets; the large majority of broken shafts, I believe, are a direct result of a jump in one or both journal boxes.

A peculiar case came under my notice recently. Three shafts in one 25 H.P. engine broke within a period of one year, and all of them broke at practically the same point; the conclusion was that some unusual condition existed bout this engine which was to blame. Upon investigation, it was found that a special length was required in this shaft for the purpose of accomodating an extra heavy and wide belt; an extension shaft was coupled on to the end of the regular shaft and an outer bearing was supplied for this extension. The outer bearing was found to be out of line with the boxes on the engine base, and in order to run at all with cool boxes the operator concluded he must run with very loose box caps; he did so, with the result already stated.

I never look at a jumping shaft but I feel an immediate desire to get out of the engine room as far away as possible from the engine until it is shut down and the boxes adjusted. And yet how many an operator will tell you that he has operated his engine with loose boxes for a long time, others are as particular to have the journal boxes of their engines properly adjusted as they are to have a good igniting spark.

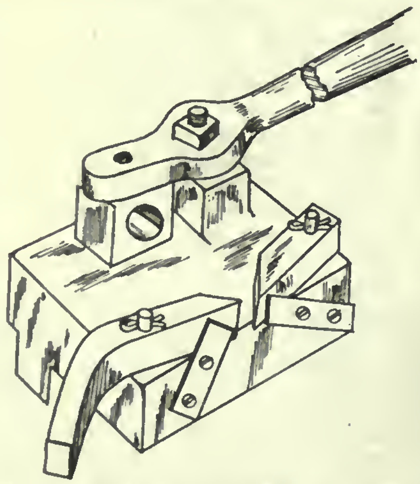
Another fruitful source of crank shaft breaking in the gas engine is premature ignition of the charges, which results in pounding in the cylinders. Ignition in these cases comes before the piston has completed its compression stroke and the expansive force resulting from the explosion tends to reverse the piston instantly and drive it back; but the momentum of the flywheel is sufficient to overcome this reversing force. The result of this clash of forces is an extra heavy strain on the crank shaft and possibly to other parts of the engine. The crank shaft is an extraordinary vital part of the engine, as well as a costly one, and it is therefore important, that every owner and operator see to it that anything tending to affect adversely smooth running should be promptly remedied.

Especially is it necessary to give all reasonable amount of time and attention to seeing that the wrist and journal boxes are in snug adjustment and properly lubricated.

A CARTRIDGE JOB

By D. A. H.

SOME thirty thousand cartridges for the Ross .303 rifle had been assembled with their jackets when it was discovered that the jackets had somehow been underfilled and the charge of lead in them was too light. It was decided to "draw" the jackets and scrap them, but to save the cartridge cases and the work was sent out to a job shop as being the proper place, so as not to interfere with the regular work of the plant. Anyone who has tried to pull the case off the jacket of a Ross bullet will tell you that it is more difficult than almost any other make, the fit being unusually tight and the jacket being set in farther than in most cases. A simple rig was made that extracted the jackets without any trouble



JIG FOR DRAWING JACKETS OF ROSS RIFLE CARTRIDGES.

though they were considerably damaged in the process.

A casting was made up to be held in a vise; to facilitate this, a lug was cast on the under side for the jaws to grip upon, which made a solid rig to work with as the plate itself rested on top of the vise. Two jaws of tool steel were pivoted near one edge of the plate with the working ends projecting over the edge where they were acted upon by flat springs. The lever shown was fitted with a swivel piece having a hole, the size of the cartridge case just under the head, placed in line with the space between the two jaws. This constituted the device which it will be seen worked on the toggle principle.

In use, the cartridge was slipped through the hole in the swivel block and the thumb kept against the head while it was pushed between the jaws against the pressure of the springs, the latter being comparatively light. A pull on the lever in the opposite direction, coupled with the spring pressure, caused the jaws to bite in the jackets and resist further movement; with the jackets held fast, the cases had to draw off as the lever was pulled further, sufficient length being provided to make the work easy. One of the jaws was extended to form a knockout, a touch on it freeing the jacket which rolled into a box beside the vise.

TURNING ALUMINUM DISCS

By D. A. N.

On the well known Metz automobile, the transmission is of the friction type with the driven member an aluminum disk about 18 inches in diameter and 5/16 inch thick, mounted on a deeply ribbed spider. In the course of time and through abuse, this disk gets scored up so badly that shifting is difficult and the driver wears out very rapidly. The logical way to reface the disk is to leave it on the spider where it is well supported and a good means of driving is available, but no, the Metz owner usually does his own work and he sees what is evident to the trained mechanic, that it is easier to remove the dozen screws that attach the disk than to remove bearings and brackets and take out the whole driven unit. Thus there comes to the machine shop an aluminum disk 18 inches in diameter by ¼ inch thick, or less, to be turned off true and straight.

One way to do the job well is to drill and tap the face plate of the lathe for flat-headed screws and to screw the disk to the faceplate just as it is fastened to the spider in the car. This is the ideal way, but some men will not want to drill up a face plate (a practice which is hard to control, once started) and others may not have a face plate big enough.

The planer will do the job quite satisfactorily and will turn out a disk that is of more uniform thickness than will a lathe that does not, of itself, face straight. By clamping the disk flat on the table and cutting not more than two inches of width at a time a satisfactory progress is made and a good cut secured. Care must be exercised to keep the piece well clamped at all times—it should not be entirely loosened up until the job is done. After cutting a section, the clamps are shifted, but before shifting a clamp is put front and back on the newly planed part to keep it down and clamps are put at the edge of the section to be next cut. A little hustle on the part of the planer man will produce as good and quick a job as could be done on a lathe. If a polish is desired, sand paper over a wood block will answer.

The question will be asked, "Why not chuck the disk?" It is so thin that it buckles under the grip of the chuck jaws which means that the cut might be straight and true in the lathe but very uneven when assembled on the car. There is no backing provided by the chuck and it is hard to grip so a cut can be taken over all, especially if the jaws are a little worn.

THE DECAY OF METALS

By decay of metals is meant changes of an unfavorable character that take place when in use or in storage, especially those that proceed completely through the mass of the metal. The simplest of these is the disintegration due to molecular change of the kind known in chemistry as allotropic. This is especially observable in tin, which becomes unstable at 644 degrees F. and may gradually change from a tough white metal into a gray powder. This condition is first manifested as small spots at which mounds of gray powder soon appear. In a short time, each spot becomes a hole, which rapidly perforates the metal. A peculiarity of this trouble is that it rapidly spreads from one place to another, like an infectious disease; it is therefore known as the "tin plague." In cold countries like Russia, the tin roofs of the affected areas are quickly destroyed when the process of decay is started. It seems as though the powder must be carried by the wind, and that wherever it settles it starts the tin decaying. Tin is also likely to undergo a molecular change at the temperature of boiling water. This is shown by the columnar structure that is frequently found in pieces of broken condenser worms. Allotropic changes occur also in lead, especially lead sheets subjected to the application of solutions containing lead salts. This change does not appear to be connected with the impurities in ordinary lead, as it seems to occur as readily with common sheet lead and the purest assay foil.

Decay may also be due to the movement of gases dissolved in a metal. This is the cause of the brittleness of nickel wires used as resistances in electric furnaces. The heating of the wire sets free the dissolved gases invariably contained in nickel. As the cooling between two periods of use is too rapid for a complete reversal of the process, a part of the gas remains undissolved between the grains of metal. As this alternate heating and cooling continues, the grains separate and the wire crumbles.

RATE MAKING—The mere fact that in the case of the wholesale customer for electric energy the public service company would be exposed to the competition of a possible isolated plant, whereas in the case of the retail customer there is no possibility of his supplying himself, does not afford any legal justification for difference in charge. In other words, the possibility of competition is not to be taken into consideration in determining the reasonableness of the classification.—Louis D. Brandeis.

The Machining of Aero Engine Parts

FIG. 1—A GROUP OF ROTARY ENGINE DETAILS MACHINED ON TURRET LATHES

The machining of many of the parts of Aero engines necessitates considerable care and ingenuity for its accomplishment. The following article reproduced through the courtesy of Alfred Herbert, Ltd., illustrates some of the more difficulty operations.

THE rotary type of aeroplane engine must of necessity be accurately balanced, since the whole engine revolves at a very high speed. It is necessary, therefore, that the components be machined all over, which necessitates a larger proportion of lathe work in this type of engine than in the fixed type. Almost all the lathe work is suitable for handling on combination turret lathes or capstan lathes, and with correctly designed lay-outs of tools may be machined with female labor to the close limits required on such work. The fact that most of the work is slender and liable to distortion necessitates roughing out all over before starting the finishing operations, and this has the advantage that in consequence the tools can be spread evenly over the operations so as to avoid undue complication and confusion to the operator.

The crankcase at the left hand side is a formidable piece of lathe work, the form of the rough material being the cylindrical block of steel shown. The centre portion of this block is trepanned out, and the blank roughly machined to shape before being handled on the combination turret lathe. The holes for the cylinders are also rough bored.

Our No. 9 combination turret lathe is used for the finishing operations, which are split up into six chuckings. One of these operations is shown in Fig. 2, the work being held in an 18-in. Coventry chuck. The special boring head is worthy of note, and is shown in greater detail in Fig. 3. It carries four cutting tools, which are clamped in steel blocks bolted to the casting. Boring heads of this type assist greatly in increasing production, and should be employed if the quantities of work are sufficient to justify making them.

Fig. 4 shows another of the operations in which profiling slides are used for finishing the interior of the crankcase. As the internal spherical surface is interrupted by the cylinder holes, it is not possible to form it, and it is, therefore, traverse bored by a single point profiling slide actuated by a former carried in the square turret.

The piece of work shown in Fig. 5 on a No. 4 capstan lathe is the short end of the crankshaft; it is located in the special fixture by the pin which has been previously turned. The hole is taper, and is finished with reamers.

In Figs. 6 and 7 we show two operations on the medium nose piece which is bolted to the front end of the crankcase. This carries the propeller boss, the shank being tapered to suit.

There are four operations on the No. 9 combination turret lathe; at the first and third the work is held as in Fig. 6, whilst at the second and fourth the work is held as in Fig. 7. The first and second operations rough out the work, leaving about 1 m/m on all surfaces, whilst the third and fourth operations are sizing operations on the corresponding surfaces. At operations 1 and 3 both sides of the rim are finished, so that it can be clamped on to a face plate fixture in operations 2 and 4. The special double facing tool will be seen on the back of the cross slide (Fig. 6).

A very difficult piece of lathe work, shown in Fig. 8, is the thrust block with which the connecting rods engage. The stamping is of high tensile steel, and the three grooves are trepanned simultaneously. The trepanning head shown is for roughing, but in the finishing and sizing heads lateral adjustment is provided for the cutters, which are arranged to cut on one side of the grooves only. Similar trepanning heads are used for machining the thrust block liners, which are finally pressed into the thrust blocks.

Figs. 9 and 10 show two operations on a propeller boss. At the first operation the taper bore and the two sides of the flange are machined. The multiple cutter boring bar shown in position carries a series of round cutters, which step out the taper bore very closely to shape, leaving a comparatively small amount for the taper reamers to remove, which

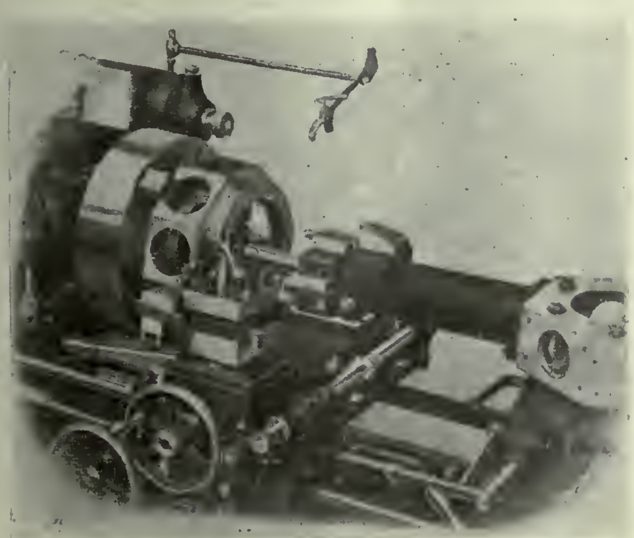


FIG. 2—FIRST OPERATION ON THE CRANK CASE

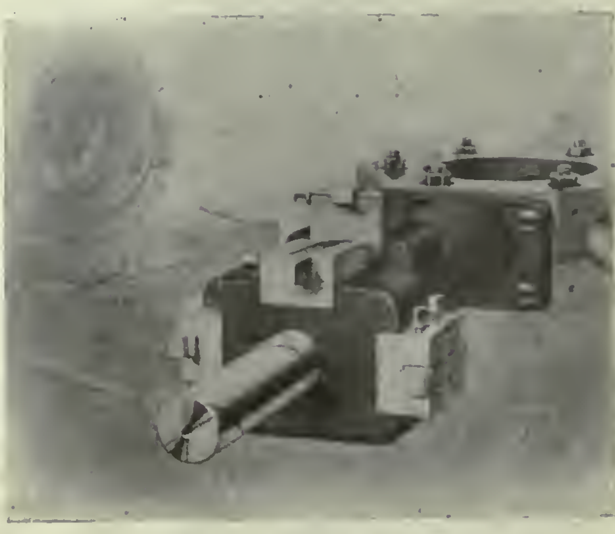


FIG. 3—THE SPECIAL MULTIPLE CUTTER BORING HEAD USED AT THE FIRST OPERATION

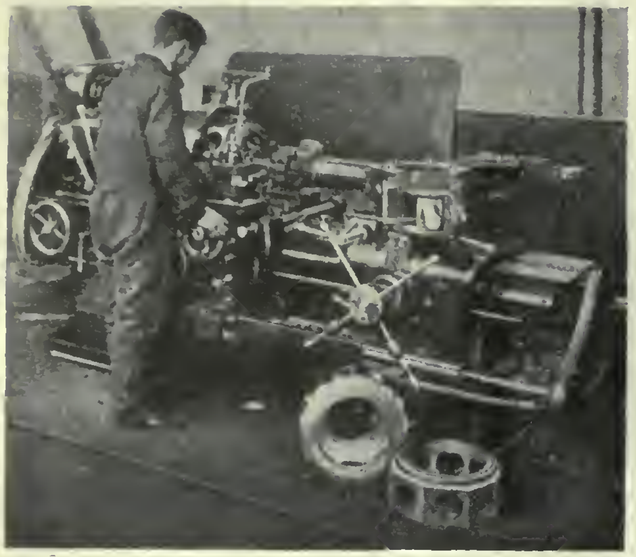


FIG. 4—ONE OF THE FNISHING OPERATIONS ON THE CRANK CASE, SHOWING THE SPECIAL PROFILING SLIDES FOR THE INTERNAL SURFACES

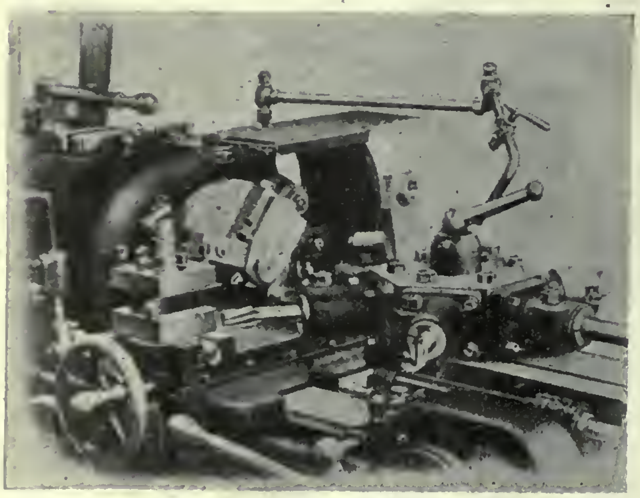


FIG. 5—THE SHORT END OF THE CRANKSHAFT MACHINLD ON A CAPSTAN LATHE

FIG. 6—FIRST OPERATION ON THE MEDIUM NOSE PIECE. THE LAYOUT FOR THE THIRD OPERATION IS VERY SIMILAR

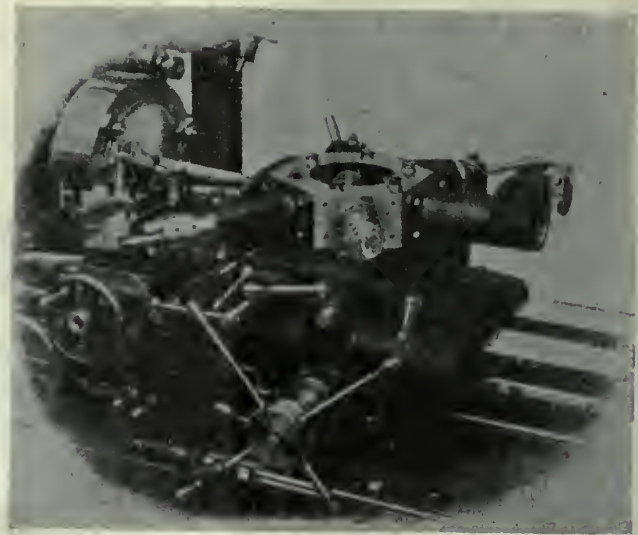


FIG. 7—FOURTH OPERATION ON THE MEDIUM NOSE PIECE. THE WORK IS SIMILARLY CHUCKED AT THE SECOND OPERATION

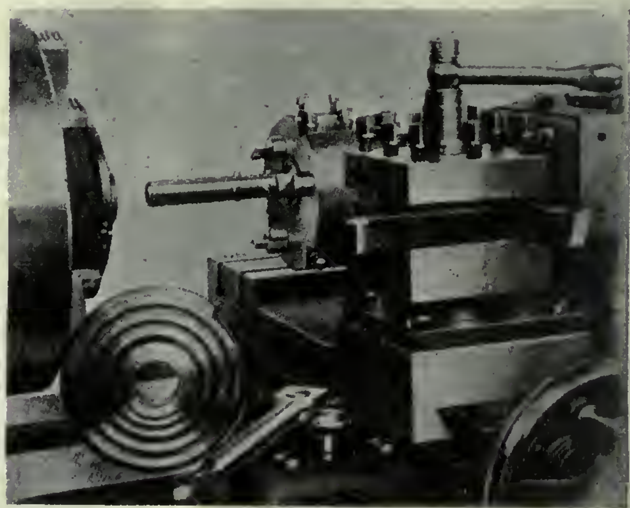


FIG 8—MACHINING THE GROOVES IN THE THRUST BLOCK WITH A SPECIAL TREPANNING HEAD.

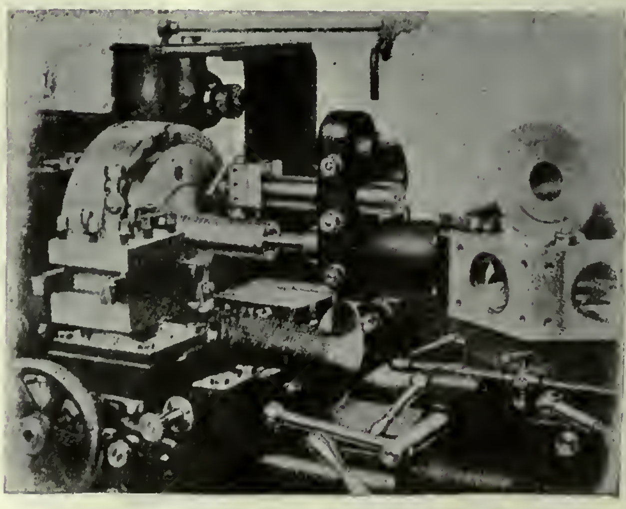


FIG. 9—FIRST OPERATION ON PROPELLER BOSS

in consequence stand up for long periods without grinding. At the second operation the work is clamped on to a face plate fixture mounted on to a Coventry chuck, whilst the outside of the boss is turned and the end counterbored.

SAVES MONEY BY ARC-WELDING

Arc-welding has been brought prominently before the public through the fact that it was used to restore the broken engine castings of the interned German ships. When breaking these castings the Germans thought they could not be repaired, and that it would require a year or more to replace them. However, even before the ships could be otherwise overhauled and made ready for transport service the broken castings had all been repaired and were good as new. This achievement has impressed the value of arc-welding upon the minds of many shop managers, and in many plants castings and other parts of apparatus which in the past would have been scrapped as hopelessly damaged, are now perfectly restored by the arc-welding process at small cost and great saving of time.

One large manufacturer, working on munitions, has installed a Westinghouse arc-welding equipment for the sole purpose of making tools for turning shells.

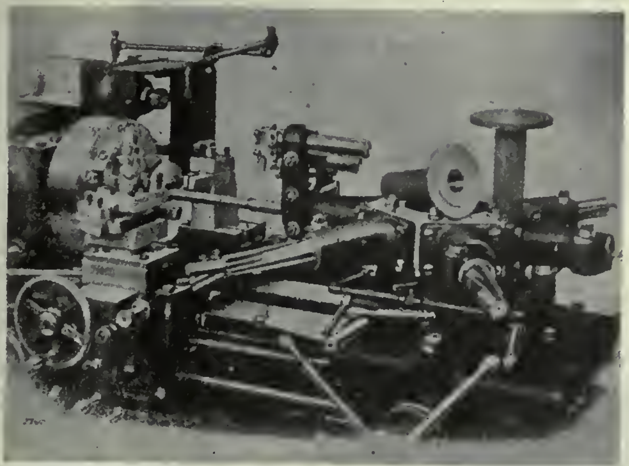


FIG. 10—SECOND OPERATION ON THE PROPELLOR BOSS

Ordinarily these tools ar[illegible] from high speed steel and cost about $12.00 each. This manufact[illegible] speed steel for the tip of the tool only, welding it to a shank of carbon or machine steel, and in this manner the tools are produced at a cost of $2.00 to $4.00.

For several weeks this plant has been turning out 240 welded tools per day, the men working in shifts of four, which is the capacity of this outfit.

The equipment consists of a 500-ampere arc-welding motor-generator with standard control panel, and three outlet panels for metal-electrode welding, and one special outlet panel for the use of either meal or graphite electrodes. This special panel is intended to take care of special filling or cutting processes which may be necessary from time to time, but it is ordinarily used in the same manner as the other panels, for making tools.

These four panels are distributed about the shops at the most advantageous points for doing the work, it not being necessary to have them near the motor-generator or main control panel.

For tool making, which involves the hardest grades of steel, a pre-heating oven is used, not because it is necessary for making a perfect weld, but because otherwise the hard steel is likely to crack from unequal cooling, and also because pre-heating makes it easier to finish the tool after the welding process has been completed. For ordinary arc-welding operations the pre-heating oven is never used.

INDUSTRIAL EDUCATION

By A. L. Haas.

It is a matter of common knowledge that a statutory measure of far-reaching importance is before the people of Great Britain in the form of a new education bill. In addition to co-ordinating virtually all existing educational resources the new Minister of Education, Mr. Fisher, has incorporated some basic compulsory proposals as to the age for school leaving. The two most radical proposals are compulsory school attendance to a minimum age of fourteen and compulsory part time attendance up to the age of eighteen. These two proposals affect every child. Besides this, secondary education is put upon a new footing, and the entire cost to the nation of the reforms will be considerable.

Some rather interesting and arresting appeals are being made in the public press to ensure the passage of the bill by unanimous consent of the people.

Influence on Engineering Industry

The following extracts from this material have a force and meaning outside the precise subject and will bear publicity for their own sake. They are published by the Manchester firm of Tootal, Broadhurst, Lee & Co., and it speaks well for industry when so prominent a firm has the public spirit to circulate such apepals broadcast, and so deprive industry of child labor and remove a long-standing reproach in the textile trade of Great Britain:

"Reason is always on the side of right."

"The State can no more misuse the minds of its children with impunity than a man with impunity can starve a hoist or neglect an engine."

"Just as the force and power of an engine must be directed by a trained man, so the energy and strength of a man must be directed by his trained intelligence."

"The battles of the future will be industrial battles."

"Nothing is to be gained by a good conceit of ourselves or a round abuse of our rivals. One thing only is inevitably sure, and this is that in the rivalry of industry the best man will win. It is Nature's law."

"The best man is the most intelligent man."

"The future of the world belongs to the democracy, which is the most rich in education and mental efficiency, which is the most strong in moral power, and which is most vitally conscious of life as a blessing. The manufacturer who uses bad machinery is beaten by the manufacturer who uses good machinery. The bad machine may be handled by a genius and the good machine by a fool, but the bad machine will never be as efficient as the good. The machinery of the modern State is its democracy."

Citizens Should be Self-Achieving

"It is in the highest interest of the State that all its citizens should feel themselves capable of achieving betterment. No worker can be really interested, whatever his wages or the conditions of his employment, if he feels that this vital instinct has been frustrated in childhood.

"Education should mean the nation's wise development of each citizen's whole nature. It should not only enable a man to improve his fortune, but to enlarge his interests. It should not only provide the citizens with a chance of getting on in the world, but give him a more interesting world in which to get on.

"Nearly all our social problems can be traced back to ignorance. Almost all the unrest of modern times may be traced back to the feeling of the individual that his instinct for betterment has been frustrated.

"The tremendous industrial rivalries of the future demand that we shall have as few social problems and as little unrest as possible."

Contemporary Effort

It is, of course, also known that contemporaneously with huge military effort Great Britain is putting forth equally great efforts not merely in industrial production, but in industrial reconstruction. The war has laid many a prejudice to rest and a new social order is appearing. It will be impossible to resurrect past conditions and equally futile to remain under the industrial conditions imposed by war. As a consequence great strides forward are being made in industrial ideas and in trying to solve the one outstanding problem of every democratic country—that of labor.

The measure of success attending the new ideas may not be commensurate with the thought and trouble involved, but a revised system of education open to all and sundry will have an important bearing on the future.

The heritage of freedom should be enhanced intelligence and a new conception of life and ideas; failing training and education, both are impossible. Among the many new proposals for the stability and settlement of the future industrial era, none promise more than new educational ideals, and labor everywhere is well advised if it supports the widest possible scheme of education, for it is the one certain road whereby the newer generation start with equality of opportunity, which is at all events the beginning of individual equality.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

ALL-STEEL BENCH DRAWER

THE all-steel bench drawer illustrated is designed to meet the needs of those whose requirements do not demand the wooden back, bottom, and front of the frictionless type built by the New Britain Machine Co. The hem of triple thickness around upper edge and the welding of all joints combine to produce a drawer of remarkable strength and durability.

ALL METAL TOOL DRAWER, SLIDE AND COVER.

With the common type of bench now almost universally used, having a thinner back plank than front one, an open space is left between the back plank and the ordinary type of drawer which invites pilfering. In this drawer however, a solid sheet metal top prohibits any tampering at rear and prevents blocking or a lockout through wedging of contents. In addition it serves to exclude any oil or water that might by accident soak through from above.

The slide ways are integral with the top and give to the drawer a smooth, free movement without binding or cramping tendency. The handle is of generous size with a shape of special design which affords a very comfortable handhold. A cylinder lock of good grade with two individual keys is provided. Master keying, if desired, may be had at cost. The possession of master key by foreman will prevent the stowing of contraband in drawers.

The drawer is sold as a unit, requires no fitting, and is easily and quickly installed without any cutting of bench. To apply, the two stops are removed and the drawer pulled completely out from slide ways. After fastening top to underside of bench with wood screws, insert drawer and replace stops.

INDUSTRIAL HOIST

The Albro-Clem Elevator Co. of Philadelphia have recently placed on the market a one-ton direct connected electric hoist, for warehouse and dock work.

This is a self-contained hoisting unit and embodies a primary worm gear reduction having a steel worm and bronze wheel running in oil, and a secondary internal spur gear reduction in the main drum.

The hoist is driven by a 5 h.p. electric motor, direct connected, which is furnished for any system of current.

The line pull or capacity on the main drum of this hoist is 2,500 lbs. at a hoisting speed of 40 ft. per minute, or the machine can be furnished for a line pull or capacity of 1,500 lbs. at a hoisting speed of 80 ft. per minute.

All control of this hoist is by one lever, which controls all operations of starting, stopping and holding the load.

The brake is automatic electric, and is capable of holding any load up to full capacity in any position.

This hoist comes with a cord and attachment plug so that it can be set up and put in operation without any previous arrangement.

This is a very convenient type of hoist, and with it a great deal of work can be accomplished with unskilled help.

FILING MACHINE

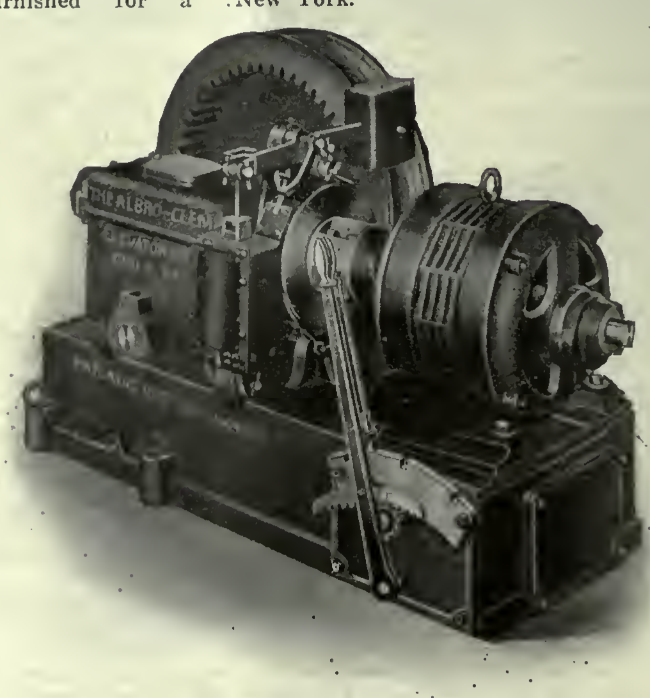
A filing machine which effects a considerable saving in the cost of filing and results in more accurate work is shown herewith.

A square tempered steel spindle is accurately ground and fitted into hand-scraped adjustable boxes, which hold the file in a rigid firm line without possibility of twisting.

The spindle is constructed with ⅜-in. hole to receive files with ⅜-in. round shanks, or any file may be used by grinding the tang so the sides are parallel and forcing it into a hole in a short piece of ⅜-in. rod. The stroke is adjustable from 0 to 2-in.

The table is adjustable to any angle required and quickly locked. The driving shaft is supported by an outer bearing. All working parts are enclosed in a dust-proof case with oil cups for all bearings.

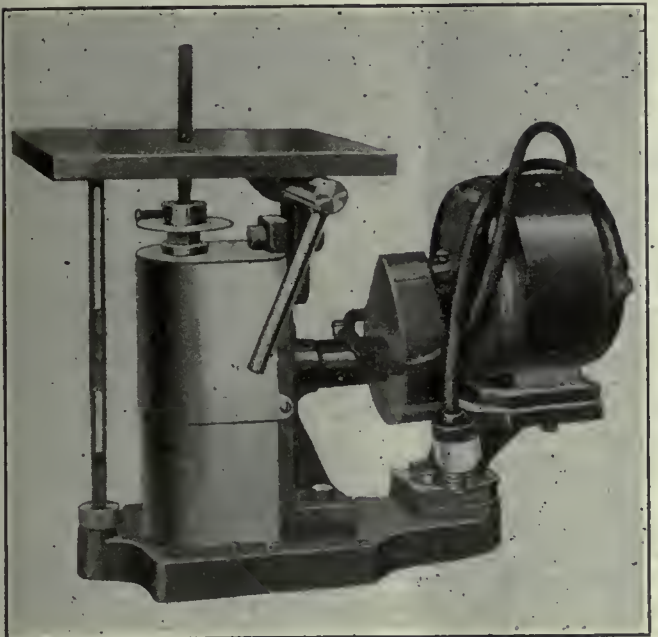
This filing machine is manufactured by the W. F. Davis Machine Tool Co., New York.



WAREHOUSE AND DOCK HOIST.

GERMANY NEEDS RAW MATERIAL

The growth of scientific knowledge with its resultant influence on the development of industry has caused a gradual and increasing appreciation of the value of raw materials—it is now beyond doubt that the intensive industrial efforts of Germany, while primarily intended to aid in the domination of the world, also pointed out the absolute necessity for control of raw materials as a primary step in the programme.



FILING MACHINE.

Now that the sands of time and the hand of fate are giving some indications of final events it is interesting to study the attitude of the German mind and an article by Prince Du Loewenstein Wertheim Frenderburg in *Die Wirklichkeit* is illuminating as showing the important part which raw materials played in causing the war and will play in the settlement

An Empty Storehouse

After the war is over, he says, the German Empire will resemble a great store which has sold out its stocks. In the first three years of war, goods, most of them raw material, to the value of $4,000,000,000 were prevented from entering Germany. There is an absolute shortage of everything "from cotton to sulphur, from seal bacon to platinum." That shortage is a serious danger, for it stands to reason that just as a man out of breath cannot run, a pumped-out state cannot engage in a new war. She must first of all get her breath.

The prince thinks it probable that a new war will follow the close of the present war. "Does anyone imagine," he asks, "that the peace will bring with it sudden quiet? Our statesmen cannot tell. Hitherto they have not been very reliable augurs. This war has surprised them, notwithstanding a hundred warnings. Our statesmen had dreamed of work brotherhoods, and then war came. One lesson we have to learn—to be on our guard. We must cast away our amazing sentimentality—this dangerous inheritance of the Teutonic race. We must see things as they really are."

Prince Loewenstein points out that at the conclusion of peace things will be no better so far as raw material is concerned unless steps are taken beforehand. Even should peace open every market in the world, it would not prevent the wildest competition for raw material and food supplies. Every cotton spinner will struggle to obtain a quick supply of cotton, every gardener will strive for seeds, every farmer for oilcakes. English and German, French and Austrian, all will madly struggle for supplies. And those who in war were allies will be economic enemies on the markets.

Want Materials, Not Money

"The spinner must have cotton if the homecoming textile workers are to have employment, and if he is to pay his burden of taxation. What will happen when these millions return from the front and cannot be employed because of the lack of raw material ? We must not rely on the possibility of obtaining supplies simply by paying for them. Money will not bring in the goods, and will foreign countries accept our paper? Besides, tonnage will have sunk to the very lowest. Against these inevitable economic catastrophes, which in certain circumstances can be almost as destructive as war itself, there is only one possible course—prevention."

The scheme of "prevention" is thus developed. "The victors in the great war, that is to say, the Central Powers, must insert this condition in the peace instrument: 'We demand a portion of the war indemnity in raw material, and this immediately and before other powers have been supplied.' The victors must be the first to eat. We thus get our goods through the State. These goods are given over to our industrials, to our farmers, traders, etc. In this way the State would fructify all necessary channels in a way hitherto unimagined and, besides, in this way we gain a good start over all competitors among foreign nations."

Raw Materials a Cure-All

Prince Loewenstein shows how Germany in this way could re-establish its national economics and avoid the catastrophe of unemployment, exorcise the spectre of want, and banish all danger. The manufacturer gets his material, the farmer his fodder, the trader his goods, the workman his earnings, the people their food, and the State its indemnity.

"England must supply tin and wool, and as for Colonies like Canada, it must yield us copper, nickel, cobalt and leather. Australia must produce spelter, wool, grain and frozen meat, and other colonies jute, leather, fats and oils, rubber, rice, tea, cocoa, etc. South Africa will supply us with gold, and Egypt, should it still remain under British rule with cotton. France will give us olive oil other oils and wine and Algeria will give us cork and phosphates. Italy will supply vegetables, sulphur, raw silk, hemp and oil, and from Russia wheat, barley, flax, oilcake, leather, eggs, platinum and bismuth."

This process of indemnification must continuous until the entire indemnity, as far as possible, has been paid. "It is only in this way and by such means that the war and its consequences can be changed for us into a source of blessing which will again raise our land and people to their old height, which will save them from the abyss of want, from crushing taxation, from mass emigration. Destiny compels us to take these steps, and we must take them or perish. It would be a crime were we to allow false magnanimity or a palsied will to prevent us utilizing our victory to the full. If we neglect this opportunity all eternity will never give us such another chance."

CORROSION IS accelerated by the contact of dissimiliar metals. As a single metal in the annealed and cold-worked conditions differs in its electrical properties, the contact of the two favors corrosion, so that a metal which is locally cold-worked is particularly likely to corrode. For this reason the corrosion of a cold-rolled metal takes place in such a way that the rolling lines become clearly visible, pitting or groves appearing in a direction parallel wit that of rolling.

SOMETIMES cracking is started by superficial corrosion. the corroding agent separating the grains of the surface layer. acting in the same way as a crack. At the same time internal stresses may increase the liability of corrosion by opening up cleavages in the grains, thus effecting a path along which the corroding agent may enter, even though the stresses may not have produced any cracks.

SILVER ARTICLES that are badly tarnished should be treated first with alcohol or other lacquer-remover, then treated with cyanide to remove tarnish, rinsed in water, dried in sawdust and lacquered.

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HIDDEN DANGERS

THE extent to which enemy inspired incendiaries and sabotage has prevailed in the United States has been so much greater than in Canada that many of our plant owners may have permitted themselves to be bullied into a false feeling of security.

The great scale on which certain war contracts were carried out by American firms, particularly in the manufacture of explosives, offered very many opportunities for outrage by enemy agents, and, in view of the God-forsaken conscience with which the Hun nation is afflicted, the wonder is that the destruction of plants has been so small.

Much good work has been done by United States authorities in dealing with the danger by means of counter-propaganda, and they have also compiled summary of precautions which everyone can take.

An ounce of prevention is better than a pound of cure, and precautions against enemy damage are just as essential as precautions against fire, contagious disease or any other known and avoidable danger. Despite the care and knowledge displayed in the erection of war time factories, there are always some few things which need adjusting after work is started and many of these involve a high degree of tact and good administration before they are finally disposed of.

Despite the presence of foreigners in considerable numbers, Canadian plants have been almost entirely free from organized effort at disturbance. The comfortable circumstances in which many well-behaved aliens have been able to maintain themselves have convinced them of the golden value of silence, which attitude may have been further induced by lack of opportunity and absence of contact with official agents. Such conditions have doubtless tended to weaken the desire to destroy which is such an ennobled Hunnish virtue, and many aliens in Canada who might at one time have been carried away with reckless admiration for the Kaiser are not now disposed even to sacrifice their job for him let alone get a jail term.

A systematic survey of conditions across the line has resulted in a distinct line of organized effort by the manufacturers. Employees are divided into four classes: Native-born, naturalized citizens, friendly aliens and alien enemies. Certificates of naturalization are looked at askance and something more convincing than the desire for a job is now necessary to secure citizenship papers.

An analysis of the plant should be made, accompanied by a map so that vulnerable spots may be located and indicated. Where will a fire do the greatest damage, where is waste accumulated, what hydrant is most vital in extinguishing a fire, where is the control of the lighting system, where will an explosion cause the most damage, what machines are most vital or difficult to replace, where can goods in transit be tampered with easiest? These and many other suggestions will occur when being considered.

An equally important feature is the kind of men in charge of these points. Germany waited forty years to start the war and her agents may be expected to wait just as patiently to finish it. The Hun has shown that he does not expect to escape destruction and wishes all others to share his fate with him. Unless the loyalty of all men in responsible positions is absolutely unquestioned, the possibility is always present that they will "keep mum" until the final chapter and then let loose a program of sabotage and crime which will be appalling. This possibility cannot be overlooked with impunity no matter how clear a man's record. It is part of their job to remain above suspicion.

The protection of important machinery and plant by isolation is a problem that has received much attention and wire fences, barred windows and armed guards abound with a frequency which is now accepted as a matter of course. No sane visitor expects to get through important plants with the ease and freedom formerly existing but it is the manufacturers' duty to see that innocent appearing workmen do not gather information in the course of their work which would be withheld from personal acquaintances of the firm. Inconsistency in this respect involves a degree of risk which is not realized as it ought to be.

Finally, employees should be treated so that no grievance remains unadjusted long enough to become a sore. Works must be fool proof as well as bomb proof and any slight disagreement may develop overnight into a dispute which may only be settled after a strike and other events have wrought their damage through delay, increased cost and other difficulties which mitigate against the winning of the war.

Delay is bad at any time, just now it is dangerous as well as expensive. See that your employees are proof against it.

REMOVING OUR BURDENS

THE hope for meeting the burdens which the war has placed upon us in the way of interest obligations is in the production of goods which will utilize our natural resources and which can also be manufactured with our present resources and marketed with more or less facility.

The attitude of Canadian manufacturers toward export business has been the subject of much discussion in recent months, and in view of disparaging remarks from some parties it is interesting to note that the Canadian Bank of Commerce has not grounds for attributing to Canadian manufacturers reluctance to enter foreign markets.

Discussing the impression that a foreign buyer is not as reliable to do business with as a domestic customer, the bank referred to declares this to be erroneous—"It is true that the foreign importer frequently seeks time on his purchases, so that if our exporters hope to secure orders in countries where it is usual to allow 30, 60, 90 or 120 days on purchases, credit must be granted in accordance with the prevailing custom. Credit risks must, of course, be carefully scrutinized in the foreign markets as in those at home, but the banks and mercantile agencies are only too pleased to secure reports on foreign traders and to place their facilities at the disposal of all shippers. . . A great many of our exporters are inclined to insist on cash with the order or cash on production of the documents at the shipping port, but little can be gained in endeavoring to develop an export business along these lines. . . Other exporting countries have seen fit to grant reasonable credit where conditions warrant it, and if our exporters hope to succeed in their foreign endeavors they must at least accord similar terms; otherwise the business will go elsewhere."

FARMERS HEAD THE LIST OF CAR OWNERS

Have It on the Skilled Trades by a Two to One Shot—Some Particulars

WHEN an old gas bus of the vintage of 1907 or so wheezes by the chances are that you turn around and murmur "Ice." Or else you give some person a nudge and say "Some boat that."

Yet the old cars that ambled around in the days of 1903 had a place in the motor world that the super-six can't crowd into now. The gas wagon that came into existence when there were only two or three to a town was a centre of admiration. The man who owned it was a greater man than the chap after whose grandfater the main street was named, and almost on a par with the deacon who tapped the corner stone of the new church with a silver trowel.

Motor cars were first licensed in Ontario back in 1903. In that year the honor roll of horse scarers contained the names of 220 guilty parties. The horse in 1903 that couldn't put its hind legs over the dash board at the opproach of a car wasn't worth wasting the pasture on.

In 1907 the registration included 517 cars owned in Ontario. The following figures tell the growth. Take the difference between 1916 and 1917. Of course it's war time and people aren't supposed to have any money for cars, but have they? Read the figures:

1917—	
Passenger car registration	78,861
Motor truck	4,929
Total	83,790
1916—	
Passenger car registration	51,589
Motor truck	2,786
Total	54,375
Increase in 1917	24,486

Of course the farmers aren't supposed to be making any money. It's just as hard a job to get a farmer to admit that he's making money as it is to get an editor to admit that he's not writing good stuff all the time.

Well now, working from the point that farmers are not making any money, let's see where the figures lead us. You'll have to do a heap of explaining to make them jibe with the hard luck story. Here they are:—

Farmers	23,409
Skilled Trades	10,937
Merchants, Manufacturers, etc.	14,825
Physicians	2,605
Other professions	3,394
Commercial Travellers	1,079
Taxicabs	1,662
Miscellaneous	20,950
Total	78,861

It is also worthy of note that the small truck, the delivery type, is by far the most numerous. The figures are:

Ambulances, etc.	41
½-ton trucks	2,072
¾-ton and 1-ton trucks	1,563
1½-ton and 2-ton trucks	513
2½-ton trucks	24
3-ton and 3½-ton trucks	575
4-ton and 5-ton trucks	118
6-ton and up	23
Total registration	4,929

Here's a Bit of a Sermon

HE went one day to get a job, he had to earn some cash, to pay his laundry ticket up and square his bed and hash. He had his nerve ten feet in length, of chest he had a heap, he wasn't lackin' not a bit in big hunks of conceit.

He wasn't goin' to do a job where he would soil his fist, or cause a spot to camp upon the watch upon his wrist.

He didn't want to swing a pick, nor drive an Irish lathe, or be a sewer digger and camp within a cave. He wanted cash for all he did, of that there was no doubt, but he didn't want to get hooked up with too much work about.

He knew about a drill he did, he knew about a file, the things he knew if stacked on edge would make up quite a pile.

He worked one year upon a farm, he used to drive a binder, he knew about a lathe, by gum, likewise about a grinder.

He'd seen a man who had a son, and this chap had been told about another friend of his who knew just how to mold. He'd often watched a smithy work about the dust and heat, and seen him nail the boots upon the Clydesdale horses' feet, and so he knew about this job, he learned by observation, but not by rollin' up his sleeves and not by perspiration.

And every time he got a job he lasted half a day, they always reached to tie a can on this here reckless jay.

There's a heap of truth in this here yarn, if you will flop your ear, and dip your head across this way so you can't help but hear—don't try to jump around and make a hopeless, foolish dazzle, but pick one job and then, me boy, just lick it to a frazzle.—ARK.

MARKET DEVELOPMENTS

Pushing the Sale of New Machinery Now

Dealers Find it Gives Better Satisfaction—Fabricating Plants Are in Reality Working on a Warehouse Basis Now—Plating Chemicals Advance Regularly Now

WAR time trade makes new grooves, and it is surprising the way in which Canadian business firms fit their lines to these channels. For instance, several bridge and fabricating plants are now, to all intents and purposes, in the warehousing business. They send out stock lists regularly to the trade, and the trade is glad of a chance to get supplies from their large stocks, because they have many lines on hand that are not being rolled at the mills either in Canada or United States at present.

Steel jobbers have numerous searchings in their efforts to fill orders sent to them. In many cases the parts for which their searches are being conducted are standard lines, and in normal times there would be no more trouble in securing them than in buying tea at a grocery store. An order for beams, for instance, is likely to cause quite a bit of farming out before all the sizes are located. Jobbers in nearly every case are working well together, and in this way orders are made ready for shipment, which would otherwise be an impossibility.

There is a tendency, and a considerable one, too, to purchase new instead of second-hand machinery. One of the largest dealers in this line stated this week that his firm was discouraging trading in second-hand machinery, and their experience was that there were better results for all in the new machinery trade. As a matter of fact there is not a very large amount of used machinery coming into the warehouses. About the only notable exception to this is part of a Hamilton plant that is now in the warehouses of a Toronto firm, following the completion of a munitions contract.

Price advances have been few during the week in general lines. The one exception to this might be in chemicals that are used in plating. There are price revisions almost daily in these lines, and it is almost impossible to keep a list at the point where it can be called correct in every detail. Prices for much used in plating work are at abnormally high levels, and there does not appear to be any good sign pointing to a let-up in the tendency of high value. Against this it is interesting to note the manner in which some steel products have kept to their level for months in the fact of keen demand and difficulty in securing supplies. There has not been, for instance, a change in the prices quoted on Canadian steel bars at the mills for over nine months, and indications are for the present level remaining.

American producing points are running well. The hot weather is going to hurt production at the open hearth furnaces, blast furnaces and rolling mills. But they have been for some time now giving a production performance of well over 90 per cent. The scarcity of good scrap metal is also hindering the best results at the open hearths. Heavy melting steel is also in great demand, but the supply is not good, and whatever comes on the market is quickly taken up.

Prices on second-hand copper and brass are stronger on the Canadian markets this week, again following the lead of the higher fixed price in U.S. for copper.

POOR QUALITY OF SCRAP HINDERS THE LARGER PRODUCTION AT U.S. POINTS

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., July 17.—The partial report of the production of steel ingots in June indicates that the total production in the month was at the rate of about 42,860,000 gross tons a year, against rates of 42,960,000 tons in May, and 42,930,000 tons in April. Thus there was a slight decrease but that is splitting hairs. The general position is that since early in March, or after the recovery from the great curtailment of the winter, production has been at a practically uniform rate of about 42.900,000 tons a year, or 90 per cent. of the full capacity. That the other 10 per cent. production was not realized was due to the trying conditions existing, a little shortage of labor, in point of numbers, a little slackness in labor performance in many quarters, unusual difficulties in making repairs and, most important of all, the poor quality, on the whole, of the scrap available and some shortness in the total supply.

There is no shortage of pig iron of any consequence, though there was a very severe shortage in the winter. Output would not be increased, but would rather be decreased, by the open-hearth furnaces using more pig iron and less scrap. What they would like is a scrap of better quality, more heavy melting steel so that they would not be driven to use so much indifferent material, particularly steel turnings.

Thus far in July the weather has been extremely favorable, for the season, but some curtailment in output this month and next is certain on account of the heat. This may be made up by better operations in September and October, but in general the production rate of the last four months indicates approximately what is to be expected for the remainder of the year. The rate is just a trifle better than the average rate of 1917 and a shade better still as compared with the 1916 output.

Distribution of Material

Recently the War Industries Board prescribed some additional regulations for the distribution of pig iron and steel products, and as there is not likely to be any further important change in the regulations it may be of interest to set down precisely the manner in which material is to be distributed. The sequence is as follows: Priorities AA, A and

B; Class C, preference material; Class D, permit material.

The priority certificates are precise in that they call upon a producer to furnish to a consuming activity a precise quantity of certain material. As a rule the material is material required for a strictly direct war use. The producer is not required to ship against all the priority certificates furnished him be fore he does anything towards shipping Class C material, but he is required to provide for filling such priorities with the greatest promptness that seems necessary.

Class C material is material coming under the "schedule of purposes entitled to preference treatment" prescribed under date of June 6th and subsequently modified slightly. The list starts with ships and ends with public utilities. The precise distribution as to quantities, etc., is left entirely to the producers. They are supposed to know, or ascertain, the exact use to which a customer will put any lot of material.

Class D material is what is left. A shipment in this category can be made only upon permit, secured from the Director of Steel Supply upon applica tion by the producer, not the buyer. One exception is made, a blanket permit being issued covering any shipment not over five tons, with this proviso, that at the end of the month the producer must report each individual shipment of this character with a statement of belief hat the shipment was "in the public interest."

Thus the system prescribes that one great class of material, Class C, shall be distributed by the producers after their own fashion, simply following strictly the general regulation laid down, as to the sequence of the "purposes" for which the material is intended by the buyer. On the one hand, however, there is material the producer is required to furnish, through the priorities, while on the other hand there is material which cannot be shipped at all except by permit. Thus there is one general flow of material, with certain exceptional material forced and certain other exceptional material restricted. Theoretically it looks like an excellent system, with a minimum of red tape and a maximum employment of the producers' knowledge of the trades they undertake to serve. Practically it is the common testimony of the producers that it is working very well.

The War Industries Board is endeavoring to reduce the volume of priorities extant by granting from week to week less than are filled. Apparently its particular activity in this direction is to seek to have the various Government departments reduce their applications for priorities, there being reason to suspect that more have been called for than were really needed. Thus as time passes there should be more material for Class C, and eventually perhaps more flowing over into Class D. Whether permits in the case of Class D will be granted freely or reservedly experience does not yet show, except that it is the testimony of some producers that the War Industries Board is quite reasonable in considering individual cases, without an undue reverence for the strict letter of its general regulations.

The Jobbers

The case of the jobbers has been settled, and apparently in a way that gives them about all they could have asked for. They are required, on the one hand, only to furnish material from stock according to the same rules as obtain with the manufacturers with respect to the preference list, and to report shipments so that they can be checked according to the regulations, but on the other hand they are assured replacement, from the mills, of all material thus shipped. Inasmuch as the jobbers for the main part have faily large stocks, they should be able to get along rather comfortably. There is, furthermore, to be some replacement of material hitherto supplied for war activities.

Prospects of General Supplies

Consumers whose activities are covered by the preference list need have little concern as to supplies. Those given no general recognition, but who can obtain deliveries only by the producer securing a permit, are likely to receive little for the time being. Instances are multiplying, however, of important war activities becoming well stocked with steel, whereby in individual cases they will not require shipments to be continued indefinitely at the rate of the past two or three months. In some cases mills have already been instructed to divert shipments to other consumers in the same class of activity. Some forge shops making shell blanks, for instance, have become loaded with material, also some fabricating shops making ship parts. Diversions to other shops may in turn give them an ample reserve. Accordingly, in some quarters it is argued that as time passes there will be more material flow over from the lowest items in the preference category, into Class D.

POINTS IN WEEK'S MARKETING NOTES

As evidence of the volume of business in the New York machine tool market, we are advised that inquiries this week represent $25,000-000 worth of business, allowing for all shrinkage.

The demand for cranes is so heavy that some shops are booked far into 1919 with this sort of business.

The supply of scrap reaching American open hearth furnaces is of a very inferior sort. There is no marked shortage of pig iron at the steel mills now.

The arrival of the hot summer weather is almost certain to have the effect of curtailing the output at the rolling mills and furnaces.

The Baldwin locomotive works is to build a new locomotive plant at Chicago. It will call for 12,000 tons of steel.

Dealers are pressing the sale of new machinery to a greater extent than ever, claiming that a more satisfactory business can be done this way than by handling used machines.

Plating chemicals are again on the rise, the advances in some lines being quite marked.

The prices on bars at Canadian mills are making a unique record,in that they have not advanced for the last nine months.

Several bridge and fabricating plants are almost in the warehousing business now, selling out their stock to the trade. Their usual line of business is at a standstill, and the mills are not rolling many of the lines with which they are well stocked.

Scrap prices on brass and copper are advanced, following the higher fixed prices granted by U.S. war board for copper.

FIRM DENIES MANY RUMORS AFLOAT

Lymburners Use Full Page In Regard to Accident at Their Plant

Lymburner, Ltd., Montreal, had an accident in their plant on Saturday morning, when part of the third floor collapsed. Five names are given as the casualty list. They are Henry David, Napoleon Prevost, Amade E. Thibeault, Joseph Beaudoin and Joseph Boyette, all of Montreal. Apparently there were so many wild statements made about the accident that the management considered it necessary to officially contradict them a full page, signed by E. Halley, vice-president and general manager was used in Montreal papers for this purpose, and stated:

To correct the many false and unfounded rumors that were falsely circulated in connection with an accident that occurred at our plant this morning: Lymburner, Limited, situated at 360 St. Paul St. East, makes this full page announcement in the *Standard*: There is always a certain class of people who like to talk in a sensational manner and who are therefore very often more detrimental to society than they are useful, and it is those people alone whom we hold criminally responsible for the sensational manner in which sensational news travels, and it is to the public and our business associates that we say: "Our plant was not wrecked in any manner, shape or form, and that the loss of life was not as sensationally reported. "We wish to state to our business associates and business clients that business is going on as usual."

FEAR OF TRAFFIC TIE-UP IS THE WORST FEATURE IN MONTREAL NOW

Special to CANADIAN MACHINERY.

MONTREAL, July 17.—Considerable interest is at present centered in the possible developments of the next few days, regarding the attitude of the railroad shipment towards the ruling of the Railway War Board, respecting the wages and working conditions of these employees. Unless the next 24 hours develops a more encouraging tone, the transportation problem will become one of the greatest yet experienced. Recent conferences have failed in securing a satisfactory solution, as the men are determined to stand solid for their demands. Should a strike result, the early collapse of traffic would undoubtedly follow, as deferred repairs to rolling stock and mechanical equipment would be followed by a virtual tie-up of transportation.

No additional contracts have been placed for shells but firms that have recently obtained orders are changing over or otherwise preparing for production operations. Several new plants are about ready and others are progressing rapidly. Metal markets are operating steadily but activity is normal.

Steel Steady

The feature of the week is still the activity that marks the shell making industry. Renewal of orders has revived many plants that during the past year had practically stopped or greatly curtailed operations.

The return of the 9.2 size to local production has resulted in further forging operations. The Canada Cement are again making forgings for this size and anticipate machining in the near future. The Dominion Bridge are preparing to utilize their 6 inch forging equipment for the production of 9.2 shells, machining operations on which will be done by the St. Lawrence Bridge Co. Various plants are now forging shrapnel and work on this type of shell will soon be progressing on last year's capacity.

General steel conditions throughout the district show little change, dealers reporting nothing of special character. Priority regulations are somewhat relaxed—in form—but the possibilities of acquiring steel for other than essential purposes, remains a contending factor. With the advent of the hot weather it is anticipated that steel mills will be somewhat effected and a consequence production is expected to show a falling off. Importation of coal is well maintained but in many cases the lack of shortage facilities makes it difficult for some interests to prepare for future eventualities. One dealer here reports the movement of fuel to be very good but looks for some scarcity during the coming winter.

Metals

Apart from the continued uncertainty prevailing in the tin situation the general metal market is one of steady but featureless activity. Copper has steadied following the recent advance. Business in tin is still carried on under a cloud of uncertainty. Activity in the other metals is normal with no price changes to repart.

Copper.—Local interest has again resumed a normal character now that the tension of uncertainty has been removed by the recent revision of the price of this metal. Dealers report a steady business but almost the entire volume of metal disposed of is intended for government or other essential industries connected with war requirements. One local firm is doing a very extensive business in the brass and copper tubing and their needs are at present quite large. Dealers here have recently rvisd their quotations to meet the changed conditions at the source of supply. The new prices, which went into effect last week, are on a basis of 30 and 31 cents.

Tin.—The situation here is still one on which the dealers are unable to throw any clear light, so that present operations are carried on, more or less in the dark. Dealers report steady sales for immediate requirements but are unable to supply tin for definite future deliveries. Spot tin is scarce and visible metal is uncertain. Dealers are still quoting $1.10 per lb. but the tendency is upward.

While the new demand for machine tools is not exceptionally heavy, the enquiry for all classes of equipment is well maintained. Many plants that have been preparing for the manufacture of American shells are busily engaged in acquiring machinery and good progress is being made on installation. The new 155 m.m. shell plant of Caron Bros. is about completed and tools are now being placed. Several other local firms are waiting on equipments that has been ordered for some time. One dealer reports that considerable enquiry for equipment has recently developed from American sources but definite action has been delayed. One local machine builder has already disposed of considerable machinery to American buyers. Sales of accessory supplies are very active, particularly in relation to munition plant requirements.

Scrap Metals Stronger

Apart from the passive interest that has been shown in the advance on old copper and brass scrap, caused by the recent revision of the refined metal price, the market is devoid of special feature and dealers report a condition that is otherwise unchanged. The local advances confined to copper and brass scraps, the former showing a one cent and the latter from ¼ to ½ cent advance. Present quotations on old copper range from 20 cents for light to 23½ cents for heavy and wire. Composition turnings are quoted at 22½ cents per lb.

AFTER THE WAR WILL BE THE TIME TO EXPERIMENT ON STANDARDIZATION

"I believe that standardization can be attempted to much greater advantage in certain lines in times of peace than in times of war," stated a well-known designer of machine tools to CANADIAN MACHINERY to-day. "There is a lot of talk being done on this but when it is all ironed out I can't see where it amounts to a very great deal.

"The one thing we have to keep in mind at all times is that this war is not a permanent affair, and the element of haste is perhaps the greatest thing that enters into it. We might be able to turn out something very fine five years from now, but what are the Germans going to do in the meantime. They are certainly not going to sit down and crack their heels waiting for us to turn out some standardized form of equipment to fight them with. I'll grant you that it is much better to have a machine gun than a club when you go to war, but if you have not got the machine gun would you refuse to use the club? Perhaps that's a bit homely as an illustration, but I think you will see my point from it."

In the Motor Works

"Where would standardization work out to the best advantage?" inquired this paper.

"Well, that's a pretty big question and it would stand a whole lot of answering, but it seems that the best place for this to be worked out might be in the airplane motors and in heavy trucks. The latter would be preferable because I don't think it is possible to make a standard motor for airplane work that will be efficient in the months ahead of us. There are so many types of planes for different work that it seems hard that we should get one power plant for them that would be equally successful in all. People are making the same mistake here as they make in the States. They get the Henry Ford plant idea in their head, and they think they will run the whole war machine on the same standardization scheme that Ford has used to make his car the success it is. There are two things that kill that idea and they are (1) that bulding autos and fighting the Germans are two different things, and (2) it took Ford almost ten years to get that plant of his lined up to where he wanted it. Then again, the life of much of the machinery at the front is short. They want it quickly and they want a lot of it. We can have all the fire-place conferences we want on standardization after the war, but it seems to me that the thing now is to shove in the juice and get the stuff produced. There's a large amount of 100 per cent. efficiency outside of standardization."

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

FINISHED IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	4 55
Steel bars, base, Montreal	4 50
Reinforcing bars, base	4 50
Steel hoops	7 50
Refined iron	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 60
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$31 00	$29 50
Electro copper	31 00	29 50
Castings, copper	30 00	28 50
Tin	110 00	125 00
Spelter	11 50	11 00
Lead	10 50	10 00
Antimony	15 50	18 00
Aluminum	50 00	58 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Effective Feb. 5, 1918.

	Black	Galvanized
Standard Buttweld	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 16	7 29
⅜ in.	5 16	7 29
½ in.	6 55	8 12
¾ in.	8 28	10 41
1 in.	12 24	15 39
1¼ in.	16 56	20 82
1½ in.	19 80	24 89
2 in.	26 64	33 49
2½ in.	42 72	53 53
3 in.	55 85	70 00
3½ in.	70 84	87 86
4 in.	83 93	104 10
Standard Lapweld		
2 in.	$ 29 60	$ 36 08
2½ in.	44 46	54 70
3 in.	58 14	71 53
3½ in.	72 68	90 62
4 in.	86 11	107 37
4½ in.	97 79	122 56
5 in.	114 00	142 82
6 in.	147 80	185 28
7 in.	192 80	241 57
8 L in.	202 50	253 75
8 in.	233 30	292 32
9 in.	279 50	350 18
10 L in.	259 20	324 80
10 in.	333 70	418 18

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES

4" and under, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$20 00	$20 00
Copper, crucible	23 50	24 50
Copper, heavy	23 50	24 50
Copper wire	23 50	24 00
No. 1 machine composition	22 50	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 25	9 50
Medium brass	12 00	12 00
Heavy brass	15 00	14 50
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	34 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	26 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs	9 00	8 50
Cast borings	12 00	12 00
Stove plate	19 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 ....add	20
Machine screws, o. and fil. hd., brass ....add	25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ....plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws ....list plus	20
Collar screws .... list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ....add 40,	10
Cold pressed nuts to 1½ in....add	$4 50
Cold pressed nuts over 1½ in..add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 00
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	8 65
Can. plates, all bright.	9 50	9 50
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 20
Premier, 10¾ oz.	.....	9 50
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	37½
Disston	50
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	.....
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

Colored.

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

Wool Packing.

Arrow	25	Anvil	16
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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	46 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

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CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XX. No. 1. July 25, 1918

GROUP OF BUILDINGS AT ENTRANCE TO PLANT.

THE industrial activities of the last few years have brought about far-reaching advances in almost every line of endeavor. This is particularly true in the metallurgy of iron and steel. The electric furnace is playing an important role in this advance and its development to the point where it can be depended upon for the quantity production of high grade steel such as is required in the government specifications for shell and other munitions of war is of much interest.

The metallurgical processes connected with the refining of steel are now well established and the ability to meet the requirements of quantity production and quality combined with the ease with which scrap steel can be used as the raw material make this process admirable from many points of view. In the open hearth furnace the ratio of scrap to pig iron charged may be as high as 75 per cent. but in the electric furnace it readily approaches 100 per cent. This fact, coupled with the cost of labor will undoubtedly operate to the advantage of the electric furnace after the war.

The scrap resulting from the operation of munition plants serves as an admirable source of raw material for use in the electric furnace, and this, with the adequate supply of power available determines the equipment installed in the plant operated by the Imperial Munitions Board for the British government and described below.

The preliminary work and plans were done under the direction of Col. David Carnegie by Perin and Marshal of New York, and the construction work was let to Roger Mills and Sons of Toronto. The engineering since required has been entirely in the hands of the staff of engineers which forms a permanent part of the organization.

Plant Layout

This plant, believed to be the largest electric steel plant yet constructed, is admirably planned with ample facilities for the economical handling of all materials. Standard gauge railroad tracks, about five miles in all provide and serve every individual unit of the plant, in many cases permitting the loading and unloading of the cars under cover.

The various functions of the plant naturally center around the electric furnaces and a major portion of the trackage and equipment has to do with the handling of the raw material, steel turnings. Much of this material is stored in open stock piles in the plant yards and is handled by locomotive cranes equipped with electro-magnets. The remainder is stored under cover in a covered stock pile adjacent to the main furnace plant. This building has a capacity of about 12,000 tons of turnings and is equipped with two ten-ton Northern travelling cranes with 55-in. electro-magnets.

Bays project from the main charging floor out over the stock pile at each furnace, and the 24-in. gauge tilting scrap cars serving the furnaces are loaded by crane, pass to the weighing scales and are then dumped at a point between the furnaces convenient for their hand charging.

As may be noticed in the accompanying cross-section the layout affords ex-

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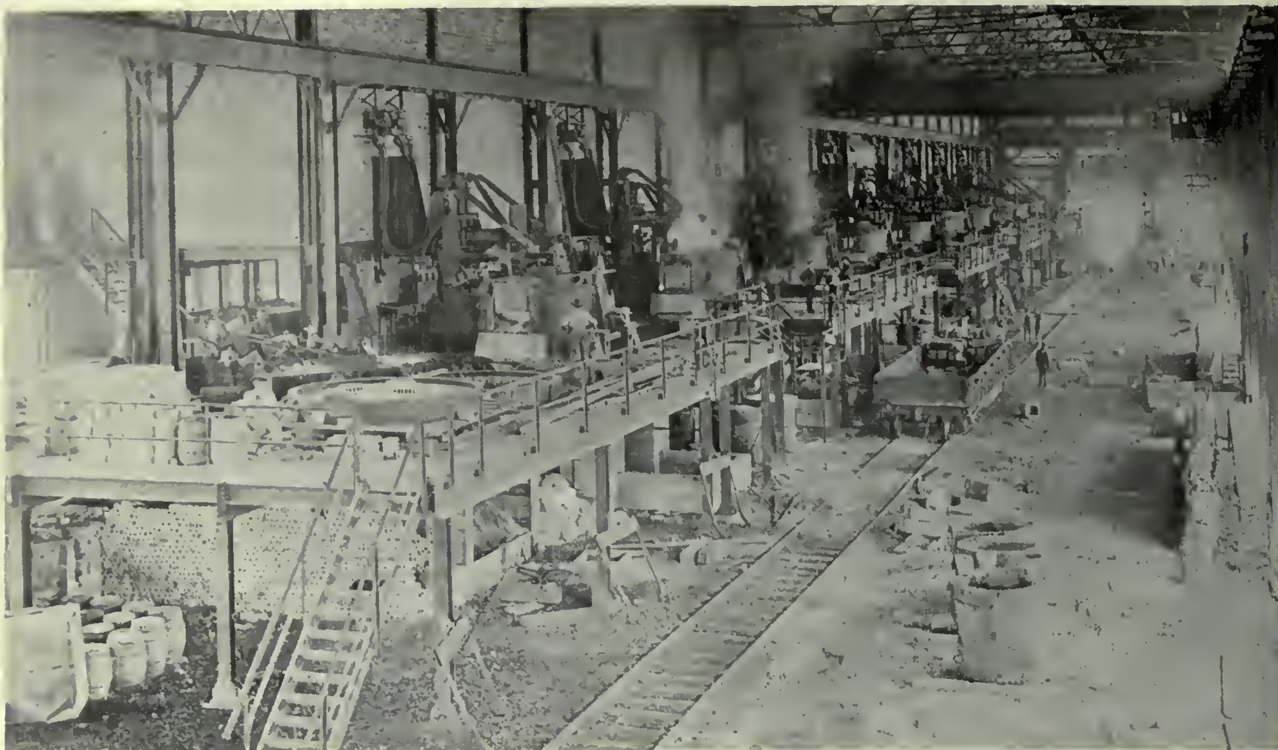


GENERAL VIEW OF MELTING HOUSE SHOWING ARRANGEMENT OF FURNACES, CHARGING AND CASTING FLOORS. A FURNACE TOP IS BEING RELINED AT THE LEFT HAND FOREGROUND.

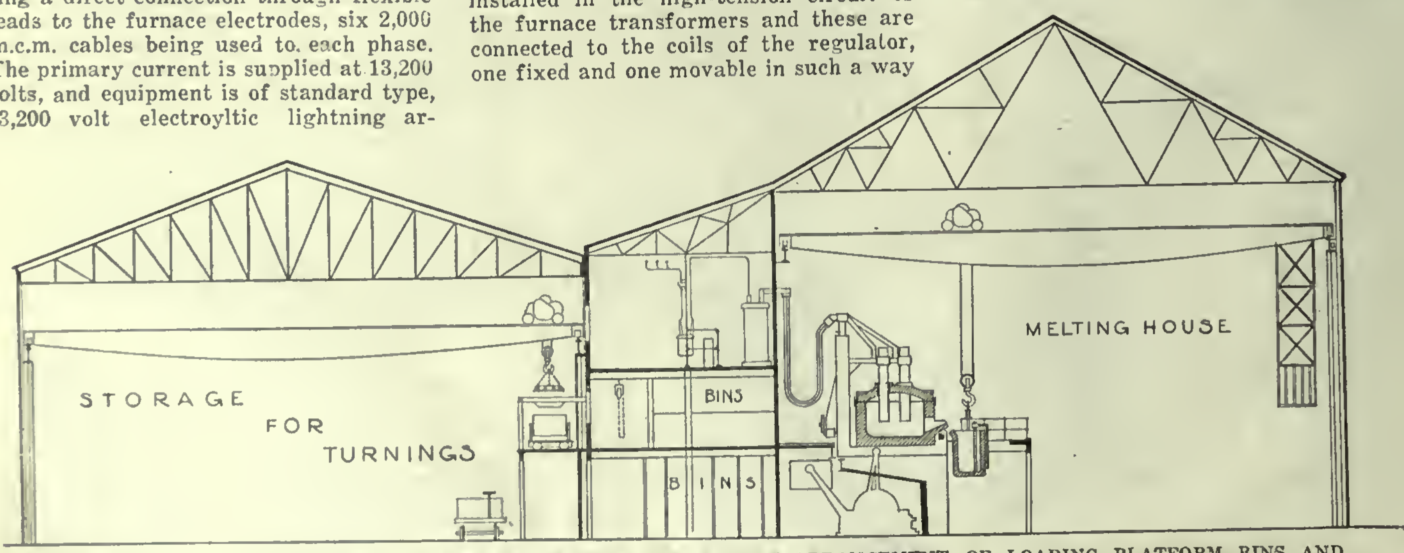
cellent storage space in the lean-to on both the charging and casting floors. This space accomodates the ferro-olloys and fluxing materials used in the various slagging operations. The building in which the ten electric furnaces are installed is 610 ft. long, 75 ft. span, and is of standard mill construction. As above-mentioned the transformers and stock bins are housed in a lean-to 25 ft. wide which runs the full length of the building.

The transformer room is enclosed in hollow tile and is raised above the furnace-charging floor, thus permitting the bins for storing the various materials used in refining to be placed directly underneath and convenient to the furnaces. The three-phase 1,500 kv.-a transformers are located directly behind the furnaces which they serve, permitting a direct connection through flexible leads to the furnace electrodes, six 2,000 m.c.m. cables being used to each phase. The primary current is supplied at 13,200 volts, and equipment is of standard type, 13,200 volt electroyltic lightning arrestors and 30,000 volt oil switches being installed.

Thury Regulators

The Thury regulators common to this type of furnace are mounted in the transformer room while the indicating instruments and winch operating controllers are mounted behind the furnaces which they serve. This regulating equipment supplied by the Westinghouse Company provides automatic regulation of the current supplied to the furnaces and produces a uniformly constant current at the electrodes subject to control by the operator in charge.

The furnace electrodes are raised and lowered by means of a motor-operated hoisting mechanism or winch, the motors in turn being controlled by means of the regulator. Current transformers are installed in the high-tension circuit of the furnace transformers and these are connected to the coils of the regulator, one fixed and one movable in such a way that when the furnace current is at its proper value the movable coil is held in equilibrium by a spring. When the current rises above or falls below its normal value this equilibrium is destroyed and the coil and the rocking lever to which it is attached are swung one way or the other and thus engage tappets and in turn release pawls which fall into notches in the rim of a tappet wheel which is given a reciprocating motion about its centre. These pawls are located upon a rocker arm which makes contact with either one of two sets of carbon contacts and according as one set or the other of these contacts is made, the winch motor is operated in one direction or the other, thus raising or lowering the electrodes. A rheostat is provided in the current transformer circuit which shunts a portion of the current and provides a means



CROSS SECTION OF TURNINGS STORAGE AND MELTING HOUSE. THE ARRANGEMENT OF LOADING PLATFORM BINS AND TRANSFORMER ROOM IS CLEARLY VISIBLE.

FURNACE TILTED AT THE FINISH OF THE MELT AND STEEL BEING TEEMED INTO LADLE.

of maintaining any constant current value desired.

In a plant of this size it is necessary to provide some means of central control from which switching operations can be carried out. This need is filled by the main control room centrally located between the two sections into which the transformer room is divided. This control room houses the main control switchboards and projects out into the furnace room giving the operators a clear view of the furnaces. The switchboards in this room carry the control and service switches and the recording and indicating meters for the plant load.

Under the main control room space has been allocated to the service equipment needed for the operation of the plant. This equipment is located on the ground or casting floor level and consists of a 60-cell storage battery for the operation of the remote controlled high-tension oil switches, 200 and 300 kw. motor generator sets for 230-volt direct current, an air compressor, oil pumps, etc.

Furnaces

Ten furnaces are installed, all of six tons capacity, and of the Heroult type. These furnaces are located on a charging floor about 12 ft. above the casting floor, the space underneath being given over to the tilting mechanism and the oil burners for pre-heating the teeming ladles. The tilting mechanism is protected from accidental breakages in the furnace lining by a brick-lined steel pan which carries any metal away and into the slag pit. Nine of the furnaces have a basic lining while the tenth is acid.

Heats are poured at short intervals, between forty and fifty being run off in the course of a twenty-four hour day, each heat taking about four hours for its completion.

The control of each melt is a matter of skill and judgment on the part of the furnace operators controlled and rigorously checked by analyses of the steel made during the melt. The laboratory in which these tests are made is housed in a separate building insuring cleanliness and the quiet conditions necessary to accurate work. A balance room is provided where all weighing necessary to the analyses is made.

The steel, when ready, is teemed into bottom-pour ladles, preheated; these in turn serve the ingot molds. The ingot molds of cast iron are of a size best adapted to the shell forging desired and the billets in the case of the 6-in. shell weigh about 200 lbs. Hot tops for the ingot molds are made in the plant, and the care taken in pouring as well as the shape of the ingot molds and hot tops insures the absence of piping except in the crop end. Before each ingot has completely solidified a metal identification tag is inserted in the crop end.

Two methods of pouring the ingots are in use. In one of these the ingot molds are stood on end in rows on the floor, while in other eighty-four of them are mounted on one truck and the truck moved instead of the crane. This results in a considerable saving of metal in the avoidance of splashing.

Four Northern cranes are installed in the melting house each with 15-ton main hoists and a 10-ton auxiliary. These cranes not only serve the teeming ladles but are used for other operations, one of their principal uses being the moving of the furnace tops to a space provided at each end of the charging floor for relining.

Breaking and Cutting-Off Shop

As soon as the ingots are cold they are sent to the breaking and cutting-off shop. This is in a separate building and a feature which has much to do with production first makes its appearance here. Manual labor is eliminated in all possible ways and conveyors adapted to the needs of each particular operation are used throughout. The ingots are carried from the furnace room to the cutting-off shop by means of a link belt conveyor running between the two buildings, and are taken off the conveyor and placed on tables serving the cutting-off machines. Here they are stamped with the melt number and are then picked up and placed in the cutting-off machines, made by the Williams Tool Co. of Erie, Pa. To deal with the ingots, seventeen of these machines have been installed in two rows down the center of the shop and pneumatic hoists are provided which eliminate all manual labor.

The ingots are cut about half way through and are then transferred to another conveyor which carries them to the pneumatic hammer. This hammer breaks

SCENE IN MELTING HOUSE—POURING INGOTS.

VIEW IN CUTTING AND BREAKING SHOP SHOWING CUTTING-OFF MACHINES, MARKING TABLES AND PNEUMATIC HOISTS

BREAKING OFF THE CROP END OF THE BILLETS IN THE CUTTING AND BREAKING SHOP

off the crop end which falls to one side, down a chute, and into a conveyor, from which it eventually finds its way into the furnaces again. The shell billet rolls the other way on to another conveyor, undergoes its first inspection and is ready for forging.

One ingot in each melt is marked with a distinctive paint and drillings are made from this to determine the chemical analysis of the steel.

The two illustrations shown of the cutting and breaking shop give a clear idea of the layout and amount of equipment necessary.

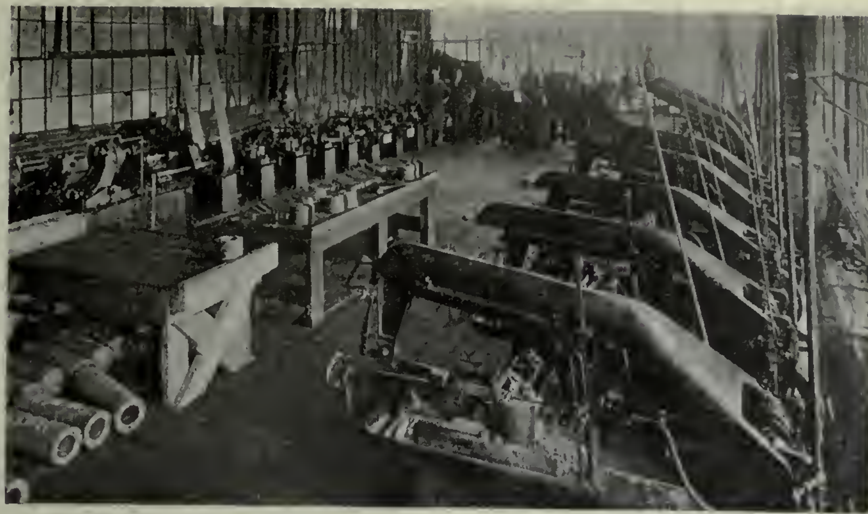
Forge Shop

The forge shop, located adjacent to the cutting and breaking shop, is a spacious steel building admirably planned for the handling and routing of the billets through the various operations. The billets as they are received from the cutting and breaking department weigh about 158 lbs. and measure about 6½ in. average diameter. Each lot as it is received is piled back of the furnaces, care being taken throughout all the operations to keep all billets belonging to the same heat number together, and separate from other lots.

The furnaces, of which there are seven, are of the continuous type, and taking in the billets at the rear end deliver them at the proper temperature at the front. Oil firing is used, the oil pressure being about forty pounds and the air pressure ten ounces. Two underground oil tanks are provided into which the fuel is run directly from the tank cars.

The hydraulic forging presses are five in number and are all of 500-ton capacity made by the Southwark Foundry and Machine Co. A water cooling system is employed to somewhat reduce the temperature of the dies and punches, a perforated pipe surrounding the upper end of the punch. The billets, while passing through the furnaces turn and come to a uniform temperature, and on reaching the front are ready for pierc-

FORGE SHOP—FURNACES AND HYDRAULIC PRESSES.



VIEW IN TEST BILLET SAW ROOM.

ing. The billet is dropped into the die and a centering ring placed on it to guide the punch. The piercing and drawing of the six-inch shell forging are done in one operation, the piercing causing an upward extension of the metal out of the die. The return stroke of the press withdraws the punch and the forging is forced up out of the die by a kicker and is removed and dropped into a conveyor for removal to the cooling beds.

The various heats are still kept separate, and when the forgings are sufficiently cooled they are again inspected, stamped with the heat number, and one or two of them picked at random and taken to the saw room.

These forgings are used for the various mechanical tests demanded by the government. The base is cut off in William's cutting-off machine similar to those in the breaking and cutting-off shop described above and test pieces are sawn out of both sides by a battery of Peerless high-speed saws made by the Peerless Machine Co., Racine., Wis. These saws cut the test piece out at one operation by means of a double saw. Following this the bases are inspected for piping or other flaws and the test pieces are turned down to the proper section for the government test.

GOTHIC STEEL, METHOD OF HANDLING THE BARS PREPARATORY TO NICKING.

Power House

The hydraulic pumping equipment necessary for the operation of a forge room of this size must necessarily be of some magnitude. This equipment is housed in a separate building and from the accompanying engraving a good idea of the layout may be gained. A battery of seven 200-gal. Dean pumps, made by the Worthington Pump Co. are installed. These pumps are geared to 200 h.p., 2 200 volt Westinghouse motors running at 500 revs. per min.

The autor starters and other switching equipment, together with the necessary switching equipment and meters, are installed on the wall adjacent to the motors which they control.

Two 28-in. accumulators of Southwark make are also installed in this building and the oil pumps for the oil-burning system are located near the oil tanks adjacent to the forge house.

VIEW OF POWER HOUSE SHOWING HYDRAULIC PUMPS AND ACCUMULATORS.

Billet Plant for Gothic Steel

One of the interesting features in connection with this plant has to do with the cutting of the bars of Gothic steel into billets of the proper size for forging and the advantages of conveyors in the increasing of production and eliminating labor are nowhere better shown than here. The steel as it is received from the cars is stacked in piles according to heat number, and as required is picked up by air hoists and placed on the gravity conveyor shown in the illustration of the steel yard.

The steel travels on this conveyor to the first position in the cutting-off shop where each bar is marked from gauges to the proper length. The bars next pass on the the same conveyor to the nicking position where they are nicked to the proper depth by the oxyacetylene torch. As shown, two gangs of men work at this position and using torches and apparatus supplied by L'Air Liquide Society rapidly nick the bars on one side to the proper depth of about one half inch. The torches are provided with supporting wheels which render the operation easier to perform.

NICKING THE GOTHIC STEEL BY THE OXY-ACETYLENE TORCH.

After the nicking operation the meit number is stamped on each portion of the bar, and the bars still travelling forward are brought to the horizontal bulldozer, where they are broken into required lengths. The next operation is the inspection, one man being stationed at this point to swing the billets in such a manner that the inspectors may readily view the end again. The billets are next stamped again and pass on to the loading system.

One of the plant's many sidings is located alongside the cutting shop and the billets are loaded into the cars by means of an ingenious gravity carrier system, it being possible to load three cars simultaneously. The engraving shows this system to advantage, the tables in the foreground serving as a place to store billets while cars are being shunted. The billets, when going to the tables are carried on a continuation of the carrier from the dull-dozer, but when being loaded into cars are carried up the elevator to the distributing center where they are guided into the proper conveyor by the man stationed at this point. A removable extension of the conveyors carries the billets into the cars where they are piled for shipment.

An extremely high rate of production is maintained in this department, a rate of 10,000 per day being easily maintained. This rate is possible through the co-ordination of the working force and by means of the conveyors, which were supplied by the Canadian Matthews Gravity Carrier Co., Toronto.

Welfare

The present trend towards better working conditions, protection from industrial accidents, and a humanitarian interest in the employees' general welfare, is well illustrated in the plant under consideration.

Much can be done in the prevention of accidents by proper guarding of points of possible danger and by the provision of warning signs where necessary. One especially commendable feature in the operation of this plant is seen in the explicit instructions for starting and controlling the apparatus of the plant.

These instructions are in most cases painted in large letters on a prominent part of the motor-starting gear and leave nothing to the operator's experience and memory.

All accidents can never be eliminated and where such occur they are taken care of in the company's own hospital with its staff. A bright and airy ward is provided for the more serious cases, and a well-equipped operating room anu diet kitchen form part of the hospital.

Meals are served at cost to the men and staff, and while conforming to the many food regulations at present in force these meals are both sufficient in quality and quantity to meet the demands of those engaged in strenuous labor.

The men's dining room seats 200, and the men may either sit down at a hot dinner of meat or fish with coffee, tea or milk, vegetables and dessert, or if desired may purchase at cost sandwiches and other food for consumption elsewhere. Tobacco is also sold.

The staff dining room is housed in a separate building adjacent to the general offices and in the two dining rooms accommodation is provided for about fifty meals at a time. A well appointed kitchen is provided and the meals here are also served at cost.

A fire brigade formed of certain of the men employed in the plant forms a very necessary feature for the operation of the fire fighting apparatus with which the plant is equipped.

TOOL STEELS

By L. V. R.

The enormous increase in the output of munitions has involved so large a demand for special tool steels that a concise statement of the most efficient heat treatment provides an acceptable contribution to the literature of the subject, and should be of great value to both tool makers and users. The special properties of these steels demand thermal treatment totally different from that of ordinary carbon steel, and many toolmakers have been long in realizing this, and thus obtaining the best value of the expensive constituents which impart the essential properties. In order to appreciate more fully the causes of hardness in these special tool steels—by which term is understood those steels, in which elements other than carbon have been added to impart the desirable properties—the cause of hardening and the effect of tempering on carbon steels are first outlined. In the annealed state carbon in steel exists as a definite carbide below 700 deg. C. As the temperature is raised beyond this point the independent crystals of carbide cease to exist, and the carbide is in a state of solution in the iron. It is in this condition that it imparts hardness. Quenched from this temperature the carbide is forcibly retained in this solution form which causes the hardening. A carbon steel thus hardened to its maximum degree, however, possesses a very low elastic limit, and is consequently quite brittle.

This initial brittleness is removed by tempering, which relieves the internal stresses set up in quenching. The softening caused by tempering is due to some of the carbide of iron retained in solution by quenching being again dedeposited. The amount is readily con-

AFTER THE GOTHIC BARS ARE NICKED BY THE OXY-ACETYLENE TORCH THEY ARE CONVEYED TO THE BULLDOZER SHOWN AND BROKEN INTO BILLETS OF THE PROPER LENGTH.

trolled by the temperature of tempering, so that any combination of properties between the extremely hard and brittle and the relatively soft annealed state can be obtained.

With carbon steels it is only possible to harden completely if the mass of the steel is small. Remarkable differences in properties are produced by comparatively slight differences in the rate of cooling.

With special steel however, this equivalent of quick cooling is obtained by the addition of elements such as nickel, manganese, tungsten and chromium. These lower the normal temperature of the carbide charge, the variation of temperature being such that it can be brought down to ordinary temperatures. Thus, in these steels, the properties are modified from within, and therefore practically the same quenching effects are obtained through the whole mass. The effect of rate of cooling is well illustrated in the case of chromium steel. Thus in a steel containing over 6 per cent. chromium and 63 per cent. carbon, it was found that with two lin. cube specimens, heated to 1,000 deg, C., one cooled on an asbestos pad in still air, and taking about half an hour to reach normal temperature, gave a Brinell hardness number of 642; while the second cooled slowly in the furnace over a period of one hour, gave a hardness value of only 281 on the same scale.

Importance of Temperature

With tungsten steels the hardening temperature is of the utmost importance. Broadly speaking, this should be practically as high as possible, short of actually melting the metal. Thus if air-hardened from 1,050 deg. C., the steel loses its hardness more quickly than if hardened from, say, 1,250 deg. C., and, further, it does not show anything like the same degree of secondary hardening. The reason for this is that the tungsten present does not go completely into solution until a temperature of the order of 1,250 deg. C., is reached. Further, the hardness thus acquired is retained through reheating up to 500 deg. C., but in addition, by increasing the secondary heating to 600 deg. C., a marked increase in the hardness takes place, and reaches a value in excess of that obtained when first hardened.

Finally, the addition of chromium to the composition usual for high speed cutting steel—for example, 18 per cent. tungston, 6 per cent. chromium, and 63 per cent. carbon—induces considerable hardness in the air hardened state, but this markedly falls off as reheating to 500 deg. C., takes place, while at 600 deg. C., a substantial secondary hardening takes place which makes the material much harder than initially air-hardened. These facts are of great importance, and indicate the desirable heat-treatment of tools before putting into use. This essential secondary hardness can be effected by either (1) air hardening and reheating to the necessary temperatures, or (2) quenching from the hardening temperature in a suitable bath of molten lead or suitable liquid which is kept at the correct temperature. The suggestion of some workers that this secondary treatment is not necesary in order to obtain the best cutting speeds, and that the same effects can be obtained by using the air-hardened tool and slowly increasing the cutting speed to the maximum, is, in a limited sense, true, the frictional heat of the work done subjecting the tool to the secondary temperature; but this treatment involves undue wear of the tool, as it passes through a relatively soft condition.

GRAVITY CARRIER USED IN DISTRIBUTING BILLETS TO FREIGHT CARS.

WORKS ACCIDENTS, THEIR CAUSES AND REMEDIES

By M. A. R.

An investibation of the factors concerned in the causation of industrial accidents has recently been conducted by Dr. H. H. Vernon on behalf of the Health of Munition Workers' Committee, and the results are now available. Data relating to upwards of 30,000 accidents were collected at four factories during periods ranging from nine months to over forty years. Some interesting conclusions are drawn and various suggestions are made for lessening the risks to which factory workers are exposed.

While speed of production is an extremely important factor, Dr. Vernon says that accidents are very largely due to carelessness and inattention, and could be diminished by preventing the workers from talking to one another. At all the factories the night shift workers suffered fewer accidents than those on the day shift. This was due, not to the smaller output but the calmer mental state of the night workers.

These workers have for the most part forgotten the excitement and pleasures indulged in shortly before coming on to night shift, and they have nothing but an unexhilarating breakfast and bed to look forward to. Such a mental state is impossible of achievement by the day shift workers, but something in the way of mental calm and equilibrium can be attained by stopping all conversation excepting that relating to the work in hand. If the workers would consent it would be a good plant to induce temporary deafness by plugging the ears and so shut out the noise of the machinery, which is in itself an important cause of distraction and fatigue. Again, if it were practical it would be of value to shut out the sight of surrounding objects by separating the lathes or other machines from one another by partitions.

Hours Influence Fatigue

It is pointed out that the production of excessive fatigue, with its accompanying increase of accidents, can be almost entirely avoided by choosing suitable hours of labor. It can also be combated by the introduction of seats for the standing workers to rest on occasionally when they are not actually working, and of the most suitable seats possible for sedentary workers. The influence of fatigue on accidents to women was strikingly shown at a fuse factory, when the operatives were working a twelve-hour day, or seventy-five hours a week. The women's accidents were 2½ times more numerous than in the subsequent ten-hour day period, but the men's accidents showed no difference. Also the women were treated for faintness nine times more frequently than the men, and were given sal-volatile twenty-three times more frequently, whereas in the subsequent ten-hour day period they were treated for faintness and given sal-volatile only three times more frequently.

It was found that women suffered twice as frequently as the men from sprains, and were especially liable to wrist sprains at the fuse factory, as they had not sufficient strength to push home the clamping lever of the lathes. The women at the shell factories suffered nearly four times more burns that the men, chiefly from hot metal turnings. Hence the sprains could be reduced by alterations of machinery and the burns by protecting the hands.

Heat Treatment and the Hardening and Tempering of Steel

By Prof. C. A. Edwards, D.Sc.
Metallurgical Dept. Manchester University

Heat treating of steel must depend to a large extent upon its carbon content and upon its other constituents. The author, in a paper read before the Manchester Association of Engineers, gives interesting facts relative to heat treating in general, both carbon and alloy steels being dealt with.

THE very wide variety of steels which are used in the industries of the present day are somewhat arbitrarily classified into two groups. These are the carbon steels and the so-called special steels.

As regards carbon steels, the chief elements other than iron, which are almost invariably present in this class are carbon, manganese, silicon, sulphur and phosphorus. Phosphorus and sulphur may definitely be regarded as impurities; phosphorus renders the metal "cold-short," whilst sulphur makes it "hot-short" or brittle when at a forging temperature. The presence of small quantities of silicon in carbon steel is often a distinct advantage, especially when considering the casting properties of the metal. With the correct amount of silicon present, the formation of blow holes can be prevented, and the contraction which takes place during solidification can be reduced to a minimum, which means less trouble as regards "piping" and "drawing."

In all carbon steels the presence of a certain amount of manganese is essential. The action of this element is twofold: (1) It reduces any oxide of iron which may have formed in the steel during the final stages of its manufacture, and since the influence of very small percentages of oxide of iron is so highly deleterious as to make it almost impossible to forge the material, the first action of manganese is that of a cleanser of the liquid metal. (2) An excess of manganese over that required to deoxidise the metal is necessary to combine with the sulphur present, and thus convert that element, from the objectionable compound sulphide of iron into the

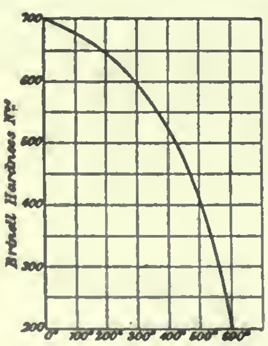


FIG. I—TEMPERING TEMPERATURE.

relatively inert compound sulphide of manganese.

Carbon.—This is the most important constituent of all steels. As regards annealed carbon steels, the influence of carbon is more or less progressively to raise the ultimate stress from, say, 18 ton per square inch when no carbon is present, up to something of the order of 40 tons with 0.90 per cent. of carbon. A still greater variation in the proportion of these steels can be brought about by subjecting them to different heat treat-

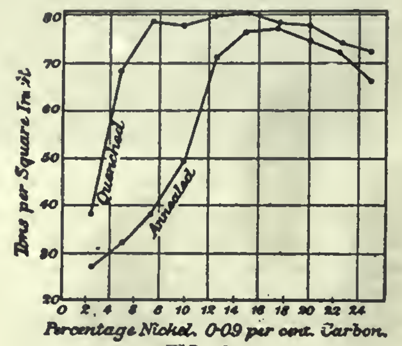


FIG. 3

ment. Briefly, heat treatment may be stated to consist (1) of hardening the metal by quenching from a temperature which depends upon the carbon content, and (2) tempering the hardened material by heating to certain low temperatures which are selected in accordance with the particular properties it is desired to obtain. It may here be useful to note, that providing the quenching is properly conducted, the degree of hardness that is attained increases more or less proportionately as the carbon percentage is raised to 0.90.

It is quite unnecessary, even if there were time and space at the author's disposal, to attempt to give a detailed description of the facts relating to the cause of the hardening that is produced as a result of this simple quenching treatment; and still less is it desirable to give

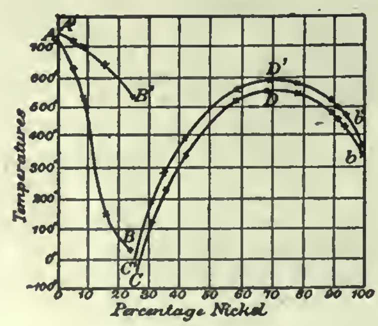


FIG. 2.

an account of the many conflicting theories which have been advanced to explain why the hardness is thus increased. Nevertheless, it will be advantageous briefly to draw attention to one or two of the more salient features in this connection, because they will make it more easy to appreciate the peculiar properties of special steels.

In the completely annealed or soft state the carbon exists as carbide or iron,

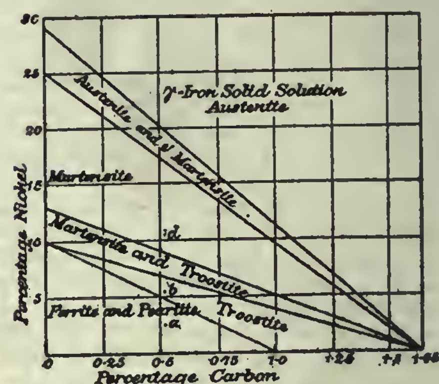


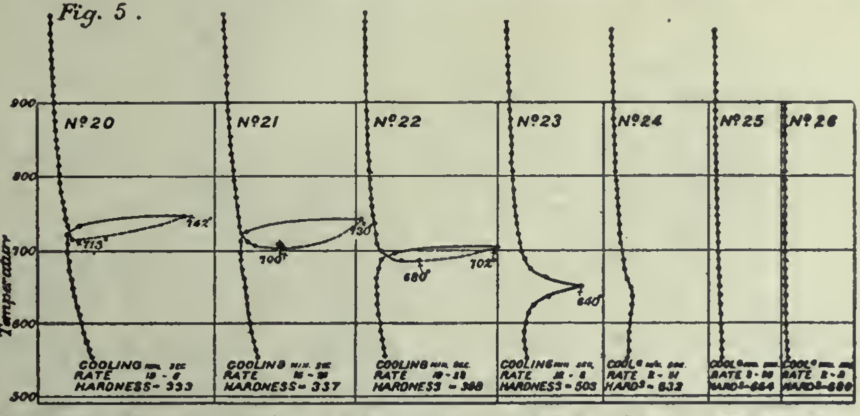
FIG. 4—NICKLE STEELS.

Fe_3C, distributed throughout the mass of iron. When this mixture is heated no physical change occurs until a temperature of 700 deg. C. is reached. At that temperature, however, what were previously independent crystals of the compound Fe_3C, and iron, cease to exist, the carbide is dissolved by the iron. This change is accompanied by an evolution of heat.

The action of the above constituent in steel, when heated to 700 deg. C, is in many respects similar to that of the two solids, ice and salt, when they are brought into contact at a temperature above minus 21 deg. C. The only difference being that in the latter instance the solution which is formed is liquid, whilst in the former it is solid. In both cases the original constituents can be separated from solution by cooling when the latent heat of solution is again given out.

Before carbon steel can be hardened by quenching it must be heated to and quenched from a temperature it which the carbide of iron is in solution. If the quenching is sufficiently rapid it prevents the separation of the carbide and the evolution of heat which accompanies that change, and it is the forcible retention of the carbide in this state which causes the hardening. If a carbon steel such as is used for machine-cutting purposes is hardened to its maximum degree, it would possess a very low elastic limit and would consequently be quite brittle.

The well-known operation of tempering is applied to remove this initial brittleness and the internal stresses which are set up in the quenching treatment. The change of hardness that is brought about by tempering carbon steels at different temperatures is qualitatively illustrated in Fig. 1, page 267; the softening is due to the carbide of iron which was kept in solution, by the sudden cooling from high temperatures, being again deposited. Since the amount



Initial Temperature, 1,200°C. Influence of Initial Temperature on Critical Cooling Velocity.

FIG. 5.

of carbide in solution can be regulated by controlling the temperature of tempering, it will be seen that any combination of properties between the extremely hard and brittle and the relatively soft annealed states can be obtained. The same results can be produced, though the operation is by no means so readily standardized, by quenching the metal in different mediums or by varying the temperature of theh quenching liquids. In both these circumstances the action is to vary the rate of cooling, and this governs the temperature at which the carbide change tends to take place, and also the amount of that transformation which actually occurs.

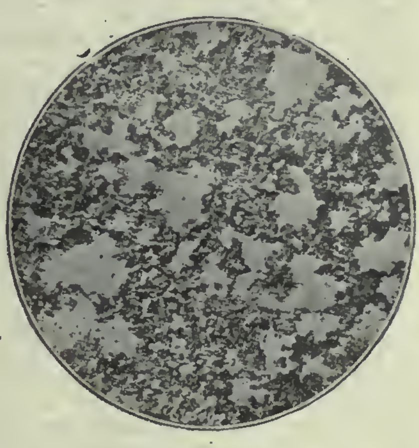
With carbon steels it is only possible completely to harden the metal if the mass of steel is small. In other words these remarkable differences in the properties are produced by comparatively slight differences in the rate at which the mass is cooled from the high temperature. For example, the exceedingly hard state is obtained if the time taken in cooling down from, say, 900 deg. C, is only a few seconds, but the metal is quite soft if the time taken to cool over the same range of temperature is something of the order of 5 minutes. Hence, it is obviously impossible to bring about any material change of hardness or tensile properties throughout the mass of a large carbon steel forging by modifying the rate of cooling. With special steels, however, this difficulty is completely overcome by the introduction of such elements as nickel, manganese, tungsten, chromium, etc, which may be regarded as producing the same effect as is attained by quenching ordinary carbon steels.

Broadly speaking, the above and other elements lower the normal temperature of the carbide change, and thus influence the general mechanical properties of the mass in a manner similar to that of rapidly-cooling carbon steels. By varying the percentage of these special constituents the temperature of the carbide change can be lowered to any degree down to the atmospheric temperature, and, in consequence of this, steels with almost any desired combination of properties can be readily obtained. There is one great advantage in the use of these special steels, namely, their properties are modified from within, and therefore, practically the same quenching effects are obtained through the whole mass.

In a lecture of this kind it would be impossible to give anything like a complete description of the properties of all the special steels which are in use, but it is hoped that, by taking a few typical examples of some of the more interesting cases, members will be able to form a fairly good idea of the action of the special elements which are used in modern steel metallurgy.

Nickel Steels.—The influence of nickel upon the thermal critical points of iron is shown diagrammatically in Fig. 2. The line AB shows the position of the critical points as they occur when the specimens are slowly cooled from moderately high temperatures. This curve, which also depicts the transformation from the non-magnetic into the magnetic state, indicates that with about 25 per cent. of nickel the change does not take place until the atmosphere temperature is reached. Therefore, with 25 per cent. of nickel and a very small percentage of carbon, the steel is non-magnetic at 0 deg. C. If, however, such a sample is cooled to below 0 deg. C. the magnetic transformation is effected, and these properties are retained even when the temperature is subsequently raised to above 500 deg. C. The corresponding changes with lower percentages of nickel and a rising temperature are illustrated by the line A′ B′.

It follows from what has just been said that steels containing from 0 per cent. to 25 per cent. of nickel when at temperatures within the A, B B′, may be either non-magnetic or magnetic according to whether they approached those ranges of temperature by being heated or cooled. This group of steels is, therefore, known as the irreversible series, because the magnetic transformation is



AFTER CURVE 21; COOLING VELOCITY 16 MIN., 28 SEC.; HARDNESS 337.

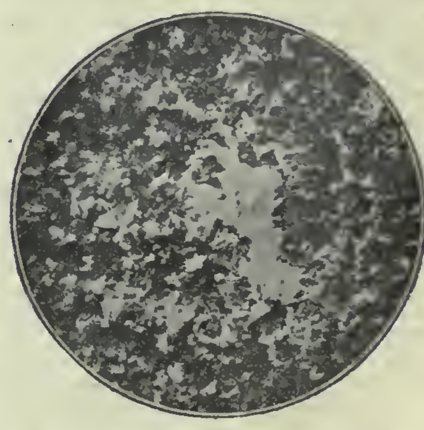


FIG. 7—AFTER CURVE 22.. COOLING VELOCITY 12 MIN., 33 SEC.; HARDNESS 398.

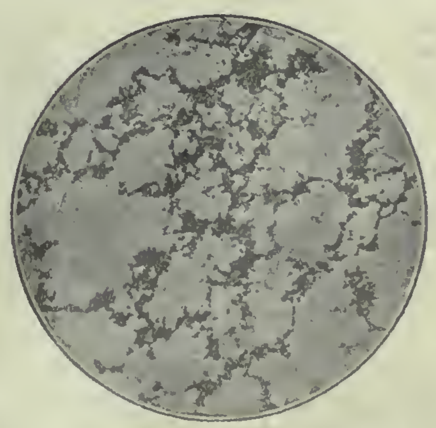


FIG. 8—AFTER CURVE 23; COOLING VELOCITY 12 MIN., 8 SEC.; HARDNESS 503.

AFTER CURVE 25; COOLING VELOCITY 3 MIN., 35 SEC.; HARDNESS 664.

not a reversible reaction as regards constancy of temperature.

Some idea of the effect of nickel upon the tensile strength of iron will be obtained from a glance at Fig. 3.

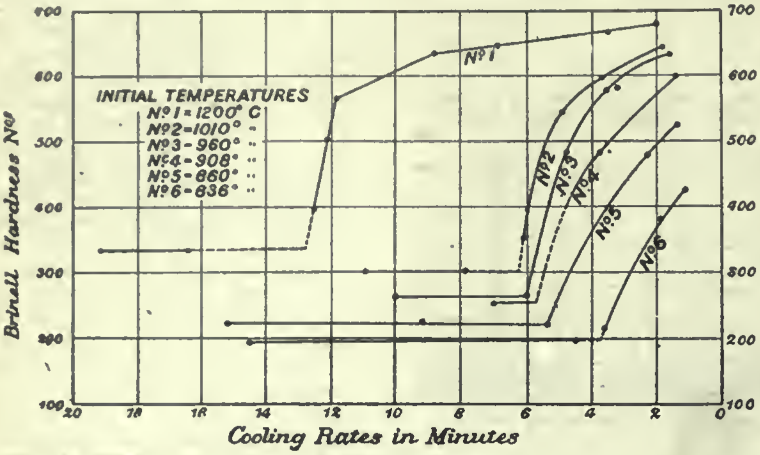


FIG. 10—EFFECT OF INITIAL TEMPERATURE ON CRITICAL COOLING VELOCITIES AND HARDNESS.

In this diagram the lower curve represents the tensile strengths of slowly-cooled specimens, whilst the upper one corresponds with the quenched materials. With the introduction and increase of carbon up to 0.9 per cent. to the nickel-iron alloys, the effect is more rapidly to raise the tensile strength, in other words, the carbon acts in the same direction as an increased percentage of nickel. Thus, for example, with no carbon the maximum ultimate stress is obtained with 15 per cent. of nickel, whilst with 0.9 per cent. of carbon practically the same properties are produced with only 7 per cent. of nickel. One interesting result of this has been indicated by Dr. Guillet, as follows:

From the diagram Fig. 3 it will be observed that a slowly-cooled steel with 7 per cent. of nickel and less than 0.12 per cent. of carbon has a tensile strength of 35 tons to 38 tons per square inch, an elastic limit of 25 tons to 28 tons, and elongation of about 30 per cent. When it is remembered that a steel containing the same amount of nickel along with

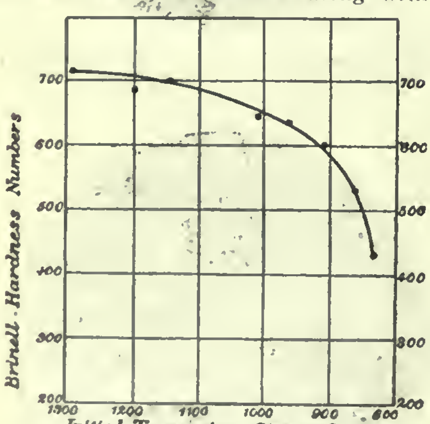


FIG. 11—EFFECT OF INITIAL TEMPERATURE ON HARDNESS WITH AIR COOLING.

0.9 per cent. of carbon, possesses, even after slow cooling, practically the same mechanical properties as a hardened cutting tool, it will be readily recognized that such facts can be advantageously utilized for certain special purposes. Starting with a steel containing 7 per cent. of nickel and 0.10 per cent. of carbon, it is possible by simply carburizing the surface and then allowing the article to cool slowly, to obtain the same results as by carbonizing and quenching an ordinary mild carbon steel. If this is done with the necessary care all the worries which accompany case-hardening by quenching can be avoided.

As a result of investigating a large number of nicked steels, Dr. Guillet has constructed a diagram (Fig. 4) which summarizes the data he got.

Whilst this chart is a very useful one, particularly as regards the effect of varying compositions upon the internal structure of the steels, there are certain defects which need a more complete explanation that he has given. Perhaps the most important point in this connection is that no account is taken of the influence of initial temperature and rate of cooling. The question of time is an extremely important one and, as I hope to show later, it needs very careful consideration. In fact, it is the author's opinion that metallurgists will in the future have to pay far more attention to the quantitative examination of the time factor than they have generally done hitherto. The necessity of studying the influence of time becomes particularly manifest when we come to consider chromium steels.

Chromium Steels.—Until quite recently different investigators held diametrically opopsite views as regards the function of chromium in steel. Some were of the opinion that this element tended to retard the carbide transformation and thus render the steel more or less self-hardening, whilst others maintained that it both raised the temperature of that change and facilitated its completion. Recent work has shown that this diversity of opinion was due to the influence of the time factor not being properly appreciated.

When making experiments with a steel containing a little over 6 per cent. of chromium and 0.63 per cent. of carbon, the author observed the following facts: Specimens, 1 in. cube, were heated to 1,000 deg. C., and then allowed to cool in the following manner—one was taken out of the furnace and allowed to cool on an asbestos pad, in still air, taking about half an hour to reach the ordinary temperature, and the other was more slowly cooled in the furnace, the time taken being about an hour. The former was extremely hard, but the latter was quite soft. The hardness values were:

	Brinell Hardness No.
Cooled in air	642
Cooled in furnace	281

These facts clearly demonstrate that the rate of cooling plays an important role in determining whether the steel becomes what is known as self-hardened or not, and they lead to a thorough investigation of the influence of time and temperature upon the hardness of this and other chromium steels.

For this purpose specimens, 1 in. cube, were heated in a small electrical-resistance furnace and then cooled at varying rates. In order to obtain the necessary variations in the rate of cooling, the samples had to be moved to different positions inside, and in some cases outside the furnace. In all experiments accurate cooling-curve data were taken and hardness determination made.

A typical series of cooling curves are given in Fig. 5, along with the corresponding rates of cooling and hardness values. A few representative microstructures are also given in Figs. 6, 7, 8 and 9. The curves and data in Fig. 5 are particularly instructive, for they give a clear indication of the close connection which exists between the character of the carbide critical point and the hardness of the steel. Comparing the curve No. 20 with No. 21, it will be noticed that the increased cooling rate has lowered the temperature at which the carbide change commenced, but in spite of this, when the transformation once began, the evolution of heat was so great as to cause the temperature of the mass to be raised from 700 deg. up to 730 deg. C. In curve No. 22 the change did not begin until 680 deg. C., and the heat that was then developed was not sufficient to give such a high rise of temperature as in curve No. 21. With curve No. 23, which was only 25 seconds quicker than the previous one, the character of the point is quite different; there is no real rise of temperature, but merely a retardation in the rate of cooling, and it will be observed that this comparatively slight acceleration in the cooling rate has produced a material increase in the hardness of the steel. With still quicker rates, the carbide change can be completely suppressed, and when this is accomplished the maximum hardness is attained. The structures in Figs. 6, 7, 8 and 9 confirm this, the dark areas represent those in which the carbide has fallen out of solution whilst the light areas correspond to an extremely hard constituent wherein the carbon has been retained in solution.

Similar results got with the same steel when cooled from different initial temperatures are plotted in Fig. 10, page 268. Here it will be seen that as the initial temperature is raised the rate of cooling may be decreased to a considerable extent and hardening of the metal is still brought about. In other words, the critical rates of cooling which are represented by breaks in the respective curves become longer as the initial temperature is raised. It should be noted that the rates that are plotted in this diagram are strictly comparable, that is to say, they are times taken to cool the

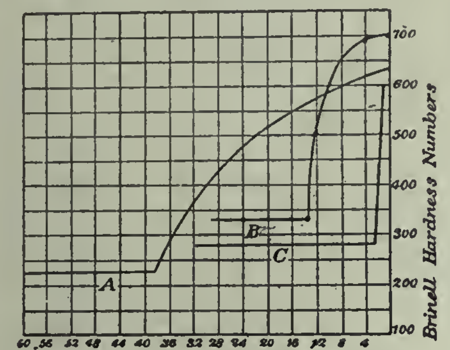


FIG. 13—COOLING RATE IN MINUTES.

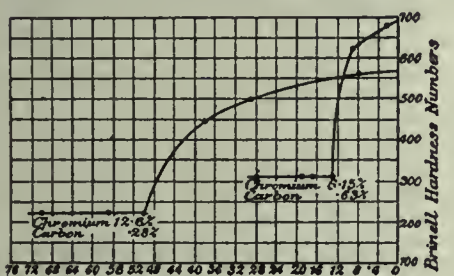


FIG. 12—COOLING RATE IN MINUTES.

specimens over a given range of temperature which was the same for all experiments. The hardnesses that were obtained for this steel when cooled in the air from varying initial temperatures are plotted in Fig. 11, page 268.

The critical cooling rates at which hardening of the steel becomes evident that have been referred to above ar not only influenced by the temperature from which the cooling commences, but also by the carbon and chromium content of the metal. To illustrate this it is only necessary to compare the results that have been got for three other samples, with those that have already been described.

If we first consider a steel containing 12.6 per cent. of chromium and 0.28 per cent. of carbon, after cooling at various speeds from 1,200 deg. C., we find that its hardening characteristics are widely different from those of a steel with 6.0 per cent. chromium and 0.63 per cent. carbon. The hardness-rate data for the two specimens are plotted side by side in Fig. 12. The hardness of the two samples in the annealed state—represented by the horizontal branches of the two curves—are substantially different, and there is a similar difference between the maximum hardness obtained by quick cooling. Perhaps the most interesting feature is that with 6 per cent. of chromium, the cooling rate at which hardening appears is 12.5 minutes, whilst the corresponding rate for the steel containing 12.6 per cent. of chromium is 50 minutes. An even better conception of the effect of composition in this connection will be gained by an examination of the curves in Fig. 13, which relate to steels having the following compositions:

	Chromium.	Carbon.
A	6.18	0.37
B	6.15	0.63
C	6.16	0.97

In this series the chromium is practically the same in each case, whilst the carbon varies from 0.37 per cent. to 0.97 per cent. It will be seen from the respective curves in Fig. 13, that sample A was more readily hardened than B, but that B was more easily hardened than C. This statement is not intended to apply to the degree of hardness which can be attained, but purely to the critical cooling rate. These facts lead us to rather a novel idea from a metallurgical standpoint, for it would appear that by starting with a steel containing 6 per cent. of chromium and 1 per cent. of carbon, if the carbon content could be reduced in any given part of an article to something below 0.60 per cent., it would then only be necessary carefully to adjust the rate of cooling to get those parts with the low percentage of carbon intensely hard whilst the other portions would remain relatively quite soft. In other words, by a process of decarburizing any required surface it should be possible to produce the well-known case-hardening effects which are now produced by carburizing other steels.

Some rather crude laboratory experiments have been made in this direction, and the results have shown that case-hardening can be accomplished in this way. Whether this is likely to prove to be of any real practical value or not the author is at present unable to say, but it would be well worth making further experiments with that in view. It might be possible to control the process as easily as the carburizing of the nickel steel already cited, and if that is found to be the case, in ordinary times the chromium steel should be considerably cheaper.

Tempering of Chromium Steel

For discussing the influence of chromium upon the tempering properties, attention will be confined to one example which has been selected on account of its indirect bearing on the question of high-speed cutting tools. Results are plotted in Fig. 14, which illustrate the effect on the hardness of tempering a hardened steel, containing 6 per cent. of chromium and 0.63 per cent. of carbon, at progressively increasing temperatures. These results may be summarised as follows: As the temperature is raised to a little above 300 deg. C., the Brinell hardness falls from above 700 to well below 600. After heating between 300 deg. and 500 deg. C. the hardness becomes a little higher than it was after treating at 300 deg. C. With temperatures above 500 deg. C. there is a rapid fall in the Brinell hardness. It should be noted that the percentages of chromium and carbon in this steel are the same as are usually present in a high-speed cutting tool; there is, however, no tungsten present, and without that element such a steel cannot be used for cutting at high speeds.

Tempering of Tungsten Steel

The effect of heating a hardened steel containing 0.63 per cent. of carbon and 19.28 per cent. of tungsten is shown diagrammatically in Fig. 15. With the exception of the absence of chromium this material is typical of a high-speed steel. In this instance it will be observed that the Brinel hardness of the steel after hardening in an air blast from about 1,300 deg. C., is only 500, but that this value does not fall after the material has been heated to temperatures up to 500 deg. C. Further, by increasing the secondary heating to a little over 600 deg. C. a marked increase in the hardness takes place, and reaches a value

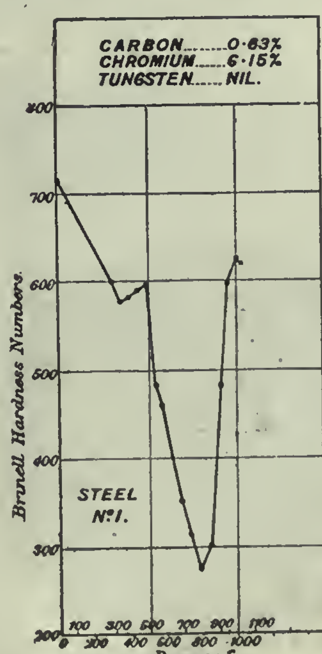


FIG. 14.

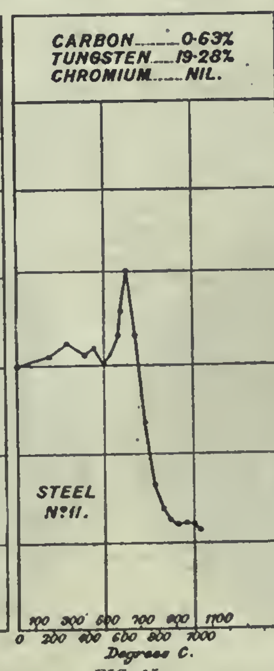


FIG. 15.

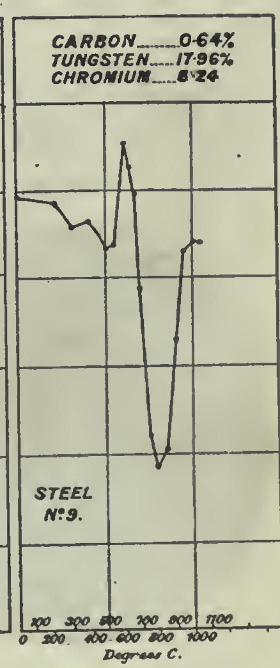


FIG. 16.

which is greater than it was when first hardened.

Tempering of Chromium Tungsten and High-Speed Cutting Steel

With steel containing 18 per cent. of tungsten, 6 per cent. of chromium and 0.63 per cent. of carbon, the effect of reheating properly hardened samples is shown in Fig. 16. Here it will be seen that the steel is very hard in the air-hardened state, and that the hardness falls rather markedly as the reheating is raised to 500 deg., but at 600 deg. C. a substantial secondary hardening sets in which makes the material much harder than it was in the initially air-hardened state.

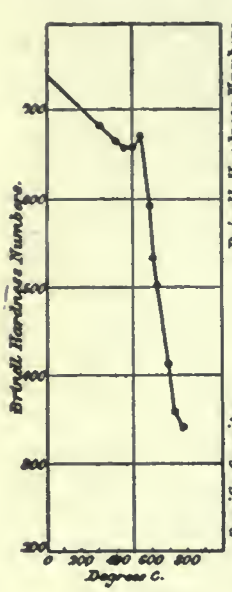


FIG. 18.

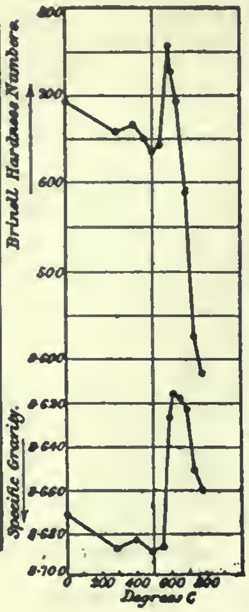


FIG. 17.

These facts are of considerable importance from the point of view of the machine shop, for they mean that high-speed tools should be treated in such a way that they possess this secondary hardness before they are put into use. This can be effected in one of two ways: (1) The tool may be air-hardened in the usual manner and then reheated to the necessary temperature, or (2) the same results can be obtained by hardening the tool by quenching, from the hardening temperature, in a bath of molten lead or suitable liquid which is kept at the correct temperature.

It has been suggested by some workers that this secondary treatment is not necessary in order to get the best cutting speeds out of a tool, and that the same results can be obtained by using the tool in the airhardened state and slowly increasing the cutting speed to the maximum. It is quite true that if this is done the frictional heat of the work done will indirectly subject the tool to the secondary heating, but in so doing it must be remembered that the tool becomes unduly worn as a result of its having unnecessarily to pass through a relatively soft condition.

Hardening Temperature

The temperature from which high-speed steels are hardened is perhaps the most important in the treatment of this class of steel. Broadly speaking, this should be practically as high as possible short of actually melting the metal. This is very clearly demonstrated in Fig. 17, which represents the influence of reheating samples of the same high-speed steel referred to above, that have been air-heated from 1.050 deg. C. In this instance it will be noted that the steel loses its hardness more quickly than if it had been hardened from, say, 1,250 deg. C., and further it does not show anything like the same degree of secondary hardening.

The difference in this respect is due entirely to the fact that the tungsten present in these steels does not completely go into solution until temperatures approaching 1,250 deg. C. are attained; and since it is to this element when in solution that we owe the property of secondary hardening and the power of retaining hardness at high temperatures, little or no return is obtained from that costly element unless the tool is heated to a high temperature prior to hardening. It should be stated that care must be taken not to heat the steel to such an extent that a partial melting occurs, for this leads to an embrittling of the tool.

Experiments have been made to determine the variations in the specific gravity of high-speed steel after being air-hardened and tempered at different temperatures. A series of these results are plotted in Fig. 18, along with the hardnesses. A change in the hardness is apparently always accompanied with a corresponding alteration in the volume. Thus, with each increase of hardness there is an increase of volume.

Photomicrograph No. 19 is typical of the structure of all chromium-tungsten cutting steels when in the annealed condition; No. 29 represents the normal structure of a properly hardened sample; whilst No. 21 shows what occurs if the steel is overheated, that is, partly melted in the hardening operation. The white irregular-shaped areas or constituent at the crystal boundaries in No. 21 are ex-exceedingly brittle, and impart very inferior cutting properties to a tool.

CONSERVE OR PERISH

Whether we have a high tariff or no tariff, an income tax or a head tax, direct or indirect taxation, bimetalism or a single standard, national banks or state banks, are matters which concern, to be sure, the temporary convenience of the members of society, but their prejudicial adjustment is easily remediable; when ill effects become apparent, the inconveniences may be removed with but little harm to the community and none to mankind at large, or to the future. But whether fertile lands are turned into deserts, forests into waste places, brooks into torrents, rivers changed from means of power and intercourse into means of destruction and desolation—these are questions which concern the material existence itself of society, and since such changes become often irreversible, the damage irremiable, and at the same time the extent of available resources becomes smaller in proportion to population, their consideration is finally much more important than those other questions of the day... Only those nations who develop their national resources economically, and avoid the waste of that which they produce, can maintain their power or even secure the continuance of their separate existence.

IRELAND has a number of ancient water power developments. Some of the corn mills have been uninterruptedly operated by water power since the seventh century, one of which is known as St. Fechin's in County Westmeath. Mills driven by water power were known in the fifth century.

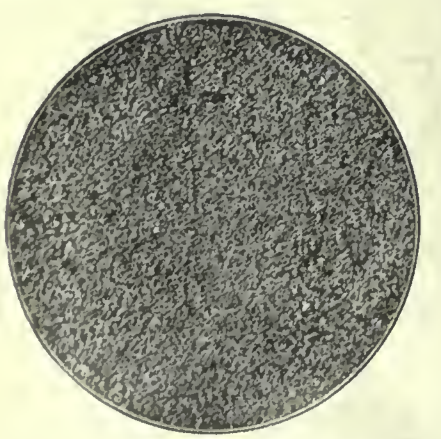
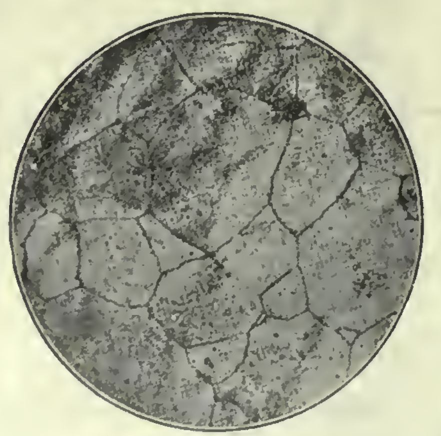
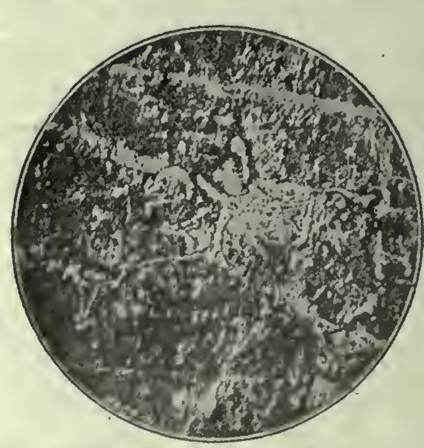


FIG. 19—ANNEALED HIGH SPEED STEEL.


HARDENED HIGH SPEED STEEL.


HIGH SPEED STEEL HARDENED AT TOO HIGH TEMPERATURE.

British Government Calls for Increased Production of Shrapnel

By A. G. WEBSTER
Associate Editor Canadian Machinery

THE new 18 pounder shrapnel Mark XII. shell which is now being manufactured in Canada differs from Mark IX in one or two particulars but is essentially the same shell. The Mark XII. shell is .615 in. shorter than the older type; the walls are a shade thicker but the base is the same. The high outside diameter of the body is 3.290 in. and the low 3.280 in., whereas the Mark IX. shell was H 3.29 in. and L 3.27 ins. The powder cup is deeper and smaller in diameter, as also the diaphragm. These variations do not necessarily involve any great change in the method of production although the firm at which the methods are employed as described below, has introduced a number of new features as a result of the experience gained in making the preceding types of shrapnel. New devices have been developed and adopted for certain operations, with the result that production per machine has been increased with a corresponding gain in effeciency. In view of the fact that more shrapnel contracts are being placed in Canada, the method of manufacture as described below will not be without interest.

Cut Off Open End

The first operation is to cut off the open end, which is done on regular cutting-off machines built by John H. Hall & Son, Brantford. The shell is held in the machine by a universal chuck and the correct position obtained by means of a rod gauge carried in a bracket on the bed. When the shell is placed in the chuck, the rod is pushed down the bore as far as it will go and the shell pulled out until the rod bottoms in the shell. The shell is then tightened up in the chuck, the rod gauge withdrawn and cut started. There are two parting tools, back and front, both working simultaneously and operated by the same feed screw in the cross slide.

Rough Facing Base

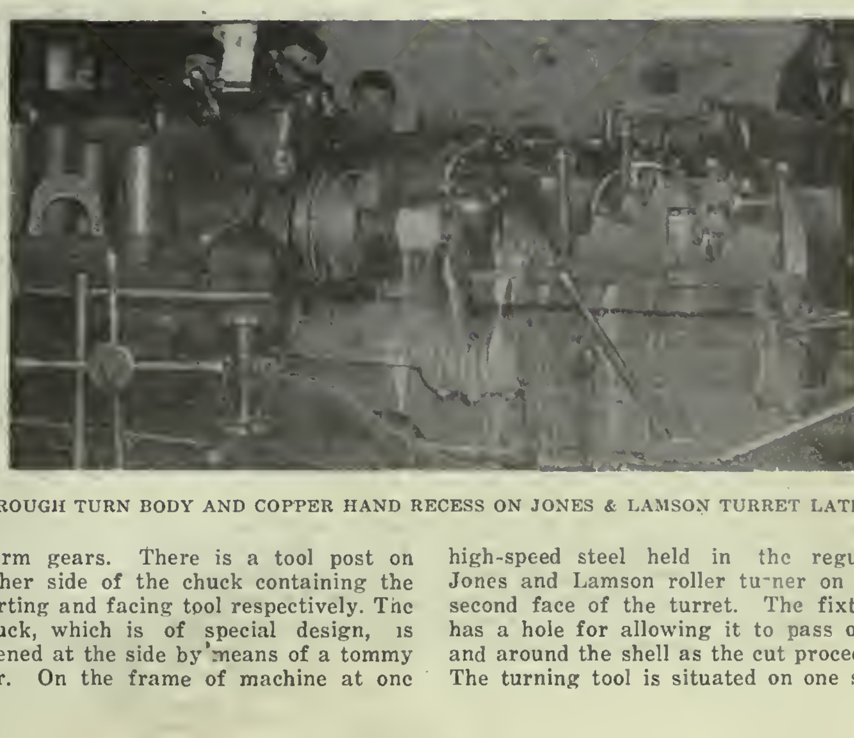
The second operation, rough facing the base, is done on a Hall cutting-off machine and also a special machine built by the Hamilton Gear & Machine Co., Toronto. The Hall machine has one facing tool on front of cross slide. There is a rod in the head for fixing the position of the shell. One roughing cut is taken across the base to remove superfluous metal preparatory to the next operation.

The standard Hall tool blocks were changed so that the high-speed steel tool may be cut off the bar without forging, the tool being set at a slant of 16 degrees, the same as an Armstrong tool holder. This construction saves all forging and about half the grinding of a standard tool.

The Hamilton Gear & Machine Co.'s cutting-off machine is used for cutting off the open end and base at one operation. The machine is belt-driven through gears from the main spindle, the tool slides being driven through worm gears. There is a tool post on either side of the chuck containing the parting and facing tool respectively. The chuck, which is of special design, is opened at the side by means of a tommy bar. On the frame of machine at one side is a bar held in a bracket for locating the shell in the correct position.

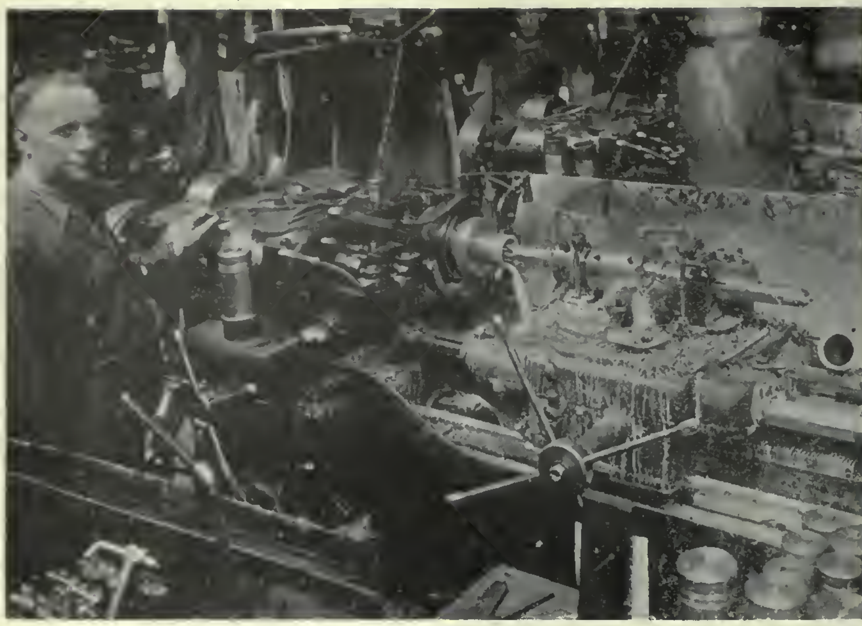
Rough Turn Body

At the third operation the body is rough turned, copper band recess rough formed and base faced. Hartness flat turret, double spindle lathes which are used exclusively for this work were built by the Jones & Lamson Machine Co., Springfield, Vt. This type of lathe is well known but the tooling fixtures were specially designed for this particular service. The turret which is square has three sets of tool fixtures, each set is in duplicate as the lathe has two spindles and two shells are thus machined at a time. The tools on the first turret face chamber the base diameter to help the tools when beginning the cut for rough turning. The shell body is rough turned for a distance of about 7⅝ ins. from the base. The tool used is ½ in. by 1 in high-speed steel held in the regular Jones and Lamson roller turner on the second face of the turret. The fixture has a hole for allowing it to pass over and around the shell as the cut proceeds. The turning tool is situated on one side



ROUGH TURN BODY AND COPPER HAND RECESS ON JONES & LAMSON TURRET LATHE.

of the fixture and there are two rollers on the opposite side. The function of the rollers is to hold the shell up to the tool and at the same time support it. The rollers engage with the shell after it has been machiner and follow immediately behind the turning tool. The turning tool works in a rocker so that it can be moved away from the work by a small lever when the cut is finished and so allow the turret to be drawn back.



ROUGH AND FINISH BORING, NOSE TAPER AND FACING NOSE ON JONES & LAMSON TURRET LATHE.

The third set of tooling fixtures was developed by the company for facing the base, forming the base radius and rough machining the copper band recess. The tool ladder is L shaped and has three tools. One tool set in a forward position faces the base. The next tool at the root of the L then forms a small radius and the third tool roughs the recess. This fixture has also two rollers set opposite to the tools for supporting the shell.

The shells are held in universal scroll chucks with floating scroll so that the pawls do not govern the position of the shell. The shell is mounted on a mandril fitted to the interior of the lathe spindle and is centered by two conical collars sliding on the mandril and driven into the tapering bore of shell by coil springs which are compressed by one action of shoving the forging on the mandril. This latter is accomplished by moving the turret forwards towards the head.

Forming Base Radius

The fourth operation is a short one and consists of finishing the base radius. An engine lathe which is used for this operation has a special fixture attached to the cross slide. This fixture has a forming tool on one side and a roller on the opposite side to steady the shell. When the shell has been chucked, the lathe carriage is brought up to the work. A bar on the fixture, operated by hand, feeds the tool forward by means of a rack and pinion and forms the radius.

Powder Cup Pocket and Diaphragm Seat

At the next operation the fifth, the shell is faced to length, the open and tapered, the powder cup pocket, diaphragm seat and the part of body just above the seat are machined. This operation is done in a Jones & Lamson flat turret, single spindle lathes, the shell being held in an automatic chuck specially designed for this purpose. The turret has four sets of tools.

The first tool is a boring bar with a forming cutter at the end for roughing the powder cup seat, diaphragm seat and the part of shell body immediately above the diaphragm seat. The second tool is a boring bar, the same as the first which takes a second cut on the powder cup seat, etc. The bar holder on the turret has a mortice carrying a cutter for facing theh open end. The third tool is a cutter for forming the taper on the open end, while the fourth is a boring bar which is similar to the first and second, finishes the powder cup seat etc. The cutters on the boring bars are in one piece and are the same shape, conforming to the contour of shell at the base, inside. The lubricant is fed through the bars to the tips.

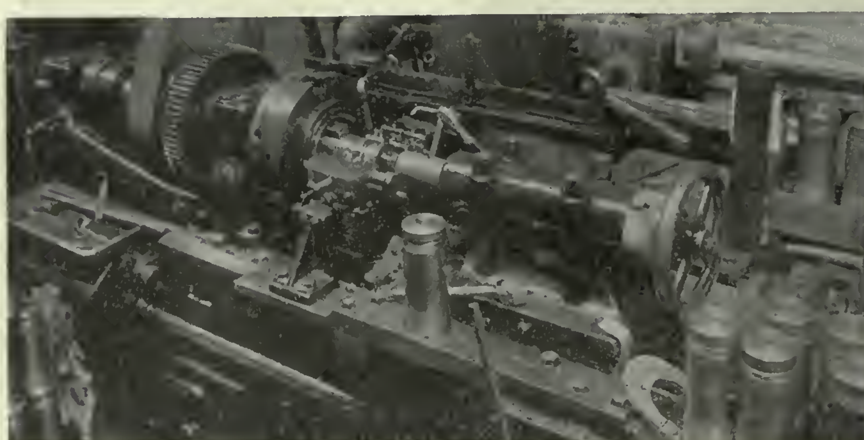
Wave and Undercuts

The sixth operation forming the wave lines and undercuts in the copper band recess is done on heavy duty Le Blond lathes equipped with Bertram attachments. This attachment which is fixed to the lathe bed consists briefly of two fixtures, the front for waving and the back one for undercutting. The waving fixture has a roller which engages with a cam on the chuck face and is pressed against the cam by means of a spring. The cam causes the fixture to oscillate and form the waves. The fixture holding the waving tool is fed in by means of a cam fastened to the lathe carriage, the cam forcing theh tool in when the carriage is traversed.

The fixture at the back carries two undercutting tools, each being fed in at an angle by cams in a similar manner to the waving tool. The waving and undercutting is done simultaneously. The back fixture also carries a guide pin which is swung over to locate the shell in its correct position. The front part of shell is held in a universal chuck and the base is carried in a cup centre on the tailstock. Oil is used in a lubricant.

Heat Treatment and Forging Nose

The heat treating installation at present comprises coal-fired furnaces, but continuous oil-fired furnaces for hardening the shells. This is the seventh operation. The shells are first hardened and then tempered. The shells are heated for 40 minutes in a temperature of about 1,450 degrees Fahr. and then quenched in oil. When a batch of shells have been quenched the oil flows out of the tank by gravity to an underground tank equipped with cold water coils which cool the oil before it is pumped back to the quenching tank. The shells are removed from this tank when practically empty. The oil is circulating almost continually in order to keep it cool. A Bristol recording thermometer is used for noting the temperature of the oil in the tank.



WAVING AND UNDERCUTTING COPPER BAND RECESS WITH BERTRAM ATTACHMENT.

The shells are tempered in a gas furnace for 40 minutes and are then allowed to cool gradually. The degree to which the temperature is drawn is regulated by the resultant schleroscope reading.

The eighth operation, the schleroscope test, now follows. Before being tested the shells are buffed in three places on the body, the band recess is cleaned up and base cleaned up on a grinder. The bore of shell is also cleaned with a wire brush. The shells are then placed on the schleroscope and several readings taken on the scale, the readings ranging from 32 to 35 degrees. At this stage one shell from a series of 500 is selected for the tensile test. The test piece 5 in. long is cut out from the body of shell, from the band recess up towards the nose, machined to the required shape and sent to the government laboratory. The requirements of the test piece are a tensile strength of 48 tons, yield 30 tons and an elongation of 12 per cent.

Lead pots are installed for heating the open end of shells before being closed in. The hydraulic nosing press was built by the Hamilton Gear and Machine Co., and operates at a pressure of 1,500 lbs. per sq. in. Closing in the nose is the ninth operation.

Nose Threads and Profiles

The tenth operation consists of boring and facing the hole in the nose, inside and outside profiles and threading the nose. This operation is done on a Jones & Lamson, flat turret, single spindle lathes equipped with an automatic chuck. There are five sets of tools on the turret. The first set rough bores the holes, faces the nose and roughs the inside profile for a short distance behind the threads. This set of tools consists of two round steel bars one turned over at the end for profiling and the second ground with a square side for rough boring the hole, while the third is square tool for facing the nose. The second tool in the turret consists of a short bar holding a forming cutter for finishing the inside profile. The third tool consists of a bar with a single pointed tool and a facing cutter. The former finishes the bore and the cutter forms the fuse socket seat bevel. The fourth tool is a collapsible tap for threading the nose. The tap was made by the Geometric Tool Co., Newhaven, Conn. The fifth tool consists of a fixture with a cutter for rough forming the outside nose profile. All the stops are set on this machine when it is being tooled up, the stops being located under the turret.

BORING AND THREADING NOSE. FORMING PROFILES AND FACING NOSE ON JONES & LAMSON TURRET LATHE.

Grind Base Diameter

The eleventh operation is grinding the base diameter, that is the part of shell between the band recess and base. This operation is done on an ordinary engine lathe equipped with an automatic chuck. The grinding wheel is on a fixture attached to the lathe carriage and it has an independent drive, and also a fan exhaust for carrying away dust.

Finish Turning Body

Finish turning the body and outside profile is the twelfth operation. This is done on an engine lathe equipped with a forming cam on the carriage. The base of shell is held in a chuck and a threaded centre is screwed into the nose and carried on the tailstock centre. A single pointed turning tool is used, the feed being controlled by the came which is located under the cross slide. A spring keeps the tool box against the cam and also forms the correct profile. The cut starts at the band recess, travels along finishing the body and then the nose profile.

Inspecting and Marking

After the shells have been finish-turned they are washed in a hot solution of soda and water to remove the grease, etc. The preliminary government inspection follows when the shells are carefully examined, gauged and weighed.

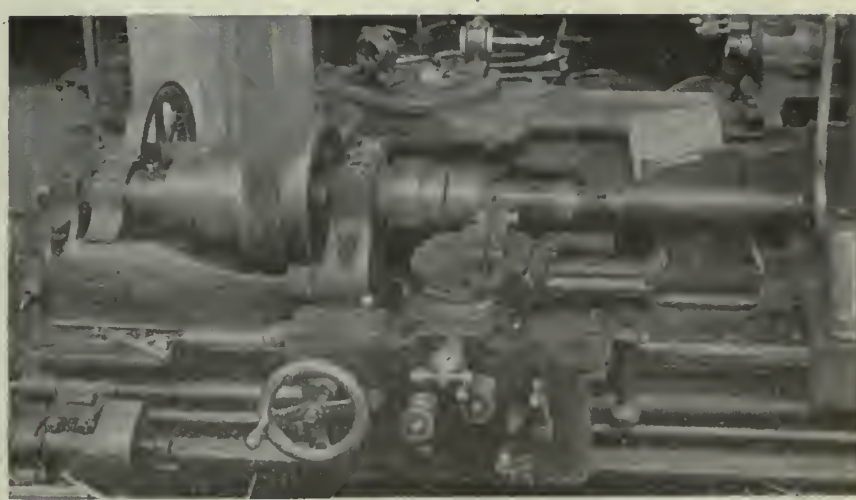
The shells are also arranged according to their series and passed along to the marking machine. This machine, which was built by the Hamilton Gear & Machine Co., is power driven and has a die holder which marks the shell resting in a horizontal position on two rollers. The marks are 18 pdr. XII., initials of the manufacturer, date, and series number. The heat number is marked on the shell body by a similar machine.

Copper Band Press

The copper band press was made by the Hamilton Gear & Machine Co. It has six hydraulic cylinders and operates at a pressure of 1,600 lbs., per sq. in. In the centre of the press there is a plunger operated by a foot lever outside. When the shell is put in the press it is raised up a short distance by means of the foot lever and the pressure applied twice. The shell being given a turn between each squeeze. This applies the pressure to the middle of the band opposite the waves. The foot lever is then released and the shell settles down to the normal position. The pressure is then applied three times, the shell being again given a turn between each squeeze. The pressure is applied on the side of the band completely filling the recess and forcing it into the undercuts.

Copper Band Turning

The copper bands are turned on engine lathe fitted up for this purpose. The base end is held in a chuck while the nose which has the screwed centre is carried on the tailstock centre. A fixture on the lathe bed carries two tools, front and back.



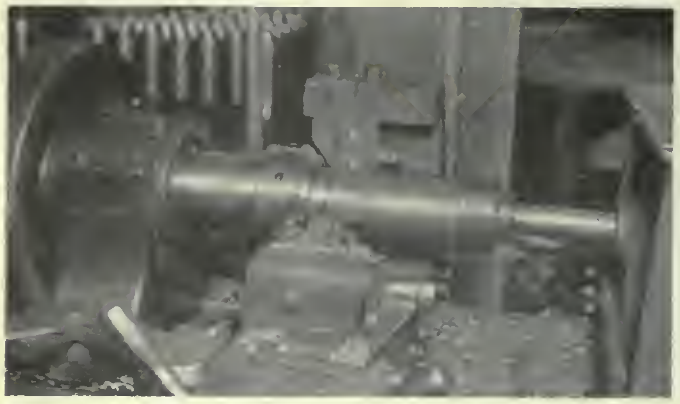
FINISH TURN OPERATION ON SHRAPNEL BODY AND PROFILE.

The tools are mounted vertically, the back tool being inverted. The band is roughed by the back tool while the front tool makes the finishing cut, the operator traversing the tool slide back and forward to marks on the rim of a 9 in.

hand wheel, giving a very fine control over the diameter of the finished band. The fixture also carries a rest for a hand turning tool which removes the burrs.

Assembling and Loading

The shells pass on to the assembling department where the tin powder cup, diaphragm and firing tube are placed in position. The tube is screwed into the diaphragm. The shells are then loaded. A shell is placed under a hopper which measures each charge of bullets. At the bottom of the hopper is a box containing approximately the quantity of bullets required. When the box is pulled out it discharges underneath, the bullets falling through a funnel into the shell. At the same time a slide on top of the box closes the exit from the hopper preventing the bullets from falling down when the shell is being loaded. A stop on the bench locates the shell in the proper position for loading. Each shell holds about 292 bullets, ½ in. diameter, and weighing 41 to the pound. The charge of bullets weighs rather over 7 pounds. The shell is rapped to settle the bullets and then weighed.



TURNING COPPER BAND.

The shells then pass on to be filled with hot resin at 350 degrees. There are two resin boilers, one above the other and heated by gas burners. To prevent any possibility of fire the top boiler has an overflow into the bottom boiler which also has an overflow into a tank under the table and away from the fire. There is a thermometer on the lower boiler. The shells are filled from the lower boiler by a ¼ in. stream of resin up to the middle of the threads in the nose. The shells are then weighed, and weight corrected by bullets or buckshot.

The brass nose socket is first entered in the threads by hand and then screwed in tight on a drill press equipped with a special three-bladed tool, something after the style of a box mill which grips with the blades, digging into the brass socket as the drill spindle is faced down by hand.

The firing tubes are at present being soldered into the brass socket but a new method is being developed for doing this work. The new device is something along the line of a boiler tube expander, which, when turned round in the tube, expands it in the socket. The new type of socket will not have a level at the edge of the hole.

Finishing Socket

The brass socket is finished in a single purpose lathe built by the Hamilton Gear & Machine Co. At this operation the inside face of socket is finished, socket profile turned and recess formed. The fixture on lathe carriage has three tools. The first is a cutter at the front which roughs the socket profile. The second tool in the centre removes the projecting end of firing tube and cleans up the face of socket. When this tool has finished its work the third tool at the back forms the recess. The middle tool holder carries a swinging stop for locating the shell in the correct position. This stop is swung back before the operation begins.

The socket is then cleaned and hand tapped, the ¼ in. grub screw hole hand tapped and powder cup cleaned out with compressed air.

Final Operations

The brass sockets are first inspected and the shells sorted into their proper series. The shells are then weighed; this is the final weighing. The proof shell is taken out, one from each series and the shells then undergo the final inspection.

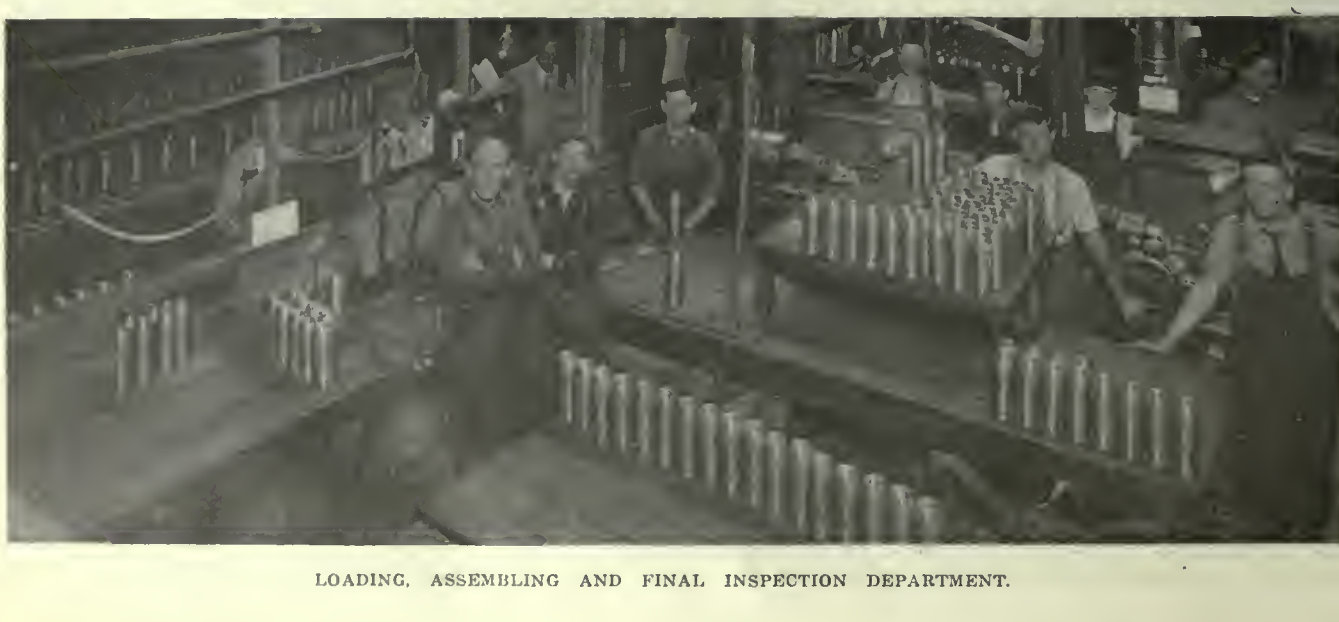
The shells are given two coats of black paint on a machine having six spindles rotated by power. The second coat is put on when the shells are dry, the body being painted lack and the nose red. The shells are afterwards placed on shelves to dry and the paint inspected. A nose plug is screwed into the nose socket and the shells are packed, six in a box.

Weights

The 18 pdr. shrapnel weighs 18 lbs. 8 ozs. with fuse and powder charge and 16 lbs. 10 ozs. 14 drs. without the fuse. At the preliminary inspection before the copper band is pressed on the shell weighs 7 lbs. 10 ozs. 8 drs,

The shell forging comes to the plant with the heat number on the base. This is transferred to the open end after the base is cut off. A symbol is used to represent the heat number throughout the various operations until marking when the original number is substituted for the symbol. The symbol or mark is transferred to the body when the open end is tapered and again to the base in the hardening room. It is transferred finally to the body at the marking operation.

The shells are inspected and gauged after each operation, in addition to the preliminary and final government inspections. An economical method of using tool steel is in vogue at this plant. Pieces of tool steel, too small to be used in the ordinary way are electric arc welded to mild steel shanks. one or more tips to a shank. These welded tips have proved both serviceable and economical.



LOADING, ASSEMBLING AND FINAL INSPECTION DEPARTMENT.

CANADA MACHINERY CORPORATION'S NEW SHOP

THE Canada Machinery Corporation has recently made an important extension to its plant at Galt, Ont., which will enable this progressive concern to extend the scope of its activities and take care of the increasing volume of business. The new building which was erected by P. H. Secord & Sons of Brantford, Ont., will be used as a machine shop, and the machinery that will be installed there will be built in the company's own shops. The new shop will be particularly useful for building the larger types of machine tools as the layout will permit of heavy machinery being installed and ample space for handling big castings. The building is of steel and brick construction and is practically fireproof. The building is 182 feet long and consists of three bays.

The centre bay is 51 feet wide and 36 feet high and covered with a gable roof. As this portion of the building projects above the other bays ample light for the centre of the building is procured by means of lantern windows. These windows, swivelling in the centre and being under control from the floor, give excellent ventilation. A twenty-five ton Niles electric crane, 24 feet above the floor, makes it possible to handle the heaviest castings or machines along the entire length of the building and to load or unload same to or from the G. T. R. switch, which enters the building at the south end.

The second or west bay is 46 feet wide and is lighted by what is practically an all glass wall. The east bay, which is 89 feet wide, is covered by a modern saw tooth type roof, which provides the maximum amount of light and ventilation. The smaller cranes are installed in this bay.

What at once attracts the notice of every practical shop man is the entire absence of steam, water, or heating pipes or electric wiring, all these services being contained in underground distribution ducts. These ducts, into which one may descend by trap doors in the floor, are very large and act primarily to convey heat to the various portions of the building, and are built of solid concrete.

INTERIOR VIEW OF NEW SHOP AT THE CANADA MACHINERY CORPORATION.

The heating apparatus consists of a large steel plate fan with direct connected steam engine, and headers of steam coils installed by Sheldons, Ltd., of Galt. It is situated in the centre of the east bay. This system of heating has the advantage in that while it will rapidly warm up a building, it provides an even distribution of heat as well as a constant change of air.

The matter of daytime lighting having been fully explained in the preceding description it remains only to say that every effort has beben made to have the artificial lighting unexcelled. While the lower portions of the building interior are painted black, the upper portions are white for the purpose of making the building as bright as possible.

CENTER BAY, FROM THE NORTH.

Both of these latter portions of the building have a clear overhead space of 16 feet. The total area of the building is 34,400 sq. ft., unobstructed by interior walls or other obstructions excepting the steel columns.

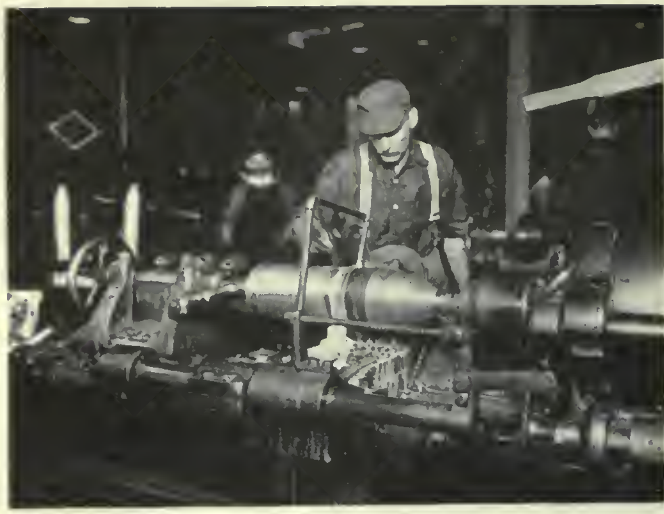
The flooring consists of a thick concrete base overlaid by 2-inch pine planking bedded in pitch, and in turn covered by hardwood matched flooring.

The centre floor is to be used in part for the placing of some of the heaviest tools used in this section of the country, including 10 ft.-16ft. boring mill, large planers, and large horizontal borers, the remainder being utilized to build such large and heavy iron tools as have previously been built by this firm only with difficulty. The west bay will be filled with somewhat lighter machinery, while the east bay will consist of an erecting floor for lighter tools and of a smithing shop, which will be located at the south end. The blacksmith shop is provided with a cement floor.

Electricity generated by steam in the company's present power house and conducted to the various points of service by underground ducts is the form of power to be used, but by means of a rotary transformer Hydro current can also be used for overtime work and lighting.

SCIENCE AND BUSINESS

In several British industries, native raw materials are now being utilized where before the war such materials were imported from the continent simply because the manufacturer did not happen to know that ample supplies of the same were at his very door, a fact of which he would have been informed had he consulted competent scientific authorities. This is well illustrated in the case of one of the largest steel corporations of England which, until 1914, had been importing from Austria, through a German firm, a certain material for lining its converters. As time wore on, and the supply diminished, complacency gave place to anxiety. Finally, the directors decided to call in scientific advice. They were referred to the geologists who informed them that a bountiful supply of the material in question was available in the immediate vicinity of their own plant. The information was acted upon, a shaft was sunk at no great distance from their furnaces, and, as a result, the company is now mining in sufficient quantities on its own account the material formerly imported.



Manufacturing the British 6 in. Mark XIII. H.E. Shell

By A. G. Webster*

AT the present time the munitions plants in Canada are producing more 6 in. H. E. shells than any other type, and in the particular plant covered in this article the methods used will be of some value in view of the fact that production has considerably exceeded contract requirements, thus indicating unusually high efficiency. In passing it may be mentioned that very good production records have been obtained in the past on other types of shell. To enable the reader to judge as to the size of the plant it may be stated that at the present time production is running at the rate of 3,700 shells in 24 hours with every possibility of the 4,000 mark being reached at no distant date.

The shell shop is divided into two sections, "A" and "B" plant. Each plant is distinct in its layout, but the system and character of the operations are identical. The machine tools used for certain operations vary in some cases, but the same results are being obtained, so there is in reality very little difference between the two plants, at least not sufficient to draw any fine distinctions and for the sake of brevity both plants will be included together.

The outstanding feature in the layout of this plant is the system of tables installed to facilitate the handling of the shells. After the shells leave the cutting off machine, at the first operation, they never touch the floor until they are boxed for shipping. Not only does this system tend to increase efficiency, but it also saves an enormous amount of time and energy, the latter being a particularly important factor when considering the weight of the 6-inch shell. A number of women are employed, which would be hardly possible except by having some system of handling the shells with a minimum amount of lifting and carrying. The tables extend in rows practically the full length of the shop while the machines are arranged in rows, in groups, on either side of the tables. In some cases as many as 5 rows of machines, with 4 in a row, are installed. The general system of drive is from line shafts motor-driven and hangers equipped with S K F ball bearings. The shells start one end of the shop, proceed up one side and down the other, finishing at the end where they started. Wherever possible air chucks are used with collet chucks or expanding mandrels according to the character of the work.

The shell which is being produced at this plant is the British 6-inch Mark XIII. high explosive. The forging weighs 120 pounds, is 6⅝ inches diameter and not less than 23 inches long.

Cut Off Open End

The first procedure is to mark the shell at the point where the open end has to be cut off. The shells are lifted from the ground to a table by an air hoist. A gauge is placed on the shell and a mark punched on the outside body, near the open end. The mark is gauged in relation to the bottom of the bore. The shells are then rolled along to the cutting-off machines supplied by John S. Hall & Sons, Brantford, Ont., and are arranged between rows of tables. The machines have two high-speed steel cut-off tools set opposite and operated simultaneously towards the centre by a cross feed screw which is operated by worm gears driven from the head-stock gear. The shells are lifted from the tables to the machines by pulley blocks and overhead runways, one for each machine. Production per machine per hour is 18.

Centering Base

The second operation, drilling the centre in base, is done on a machine equipped with an expanding mandrel and a sliding fixture holding a No. 5 combination drill and countersink. This fixture, which has an independent drive from the countershaft, is moved out of the way when the shell is placed on the mandrel and then placed in a central position. The handwheel on the spindle feeds the drill forward when forming the centre in the bore.

FIRST ROUGH TURN OPERATION ON A MONTREAL LATHE

*Associate Editor, Canadian Machinery

First Rough Turn

Bridgeford and Montreal lathes are installed for rough turning the body, which is the third operation. The Bridgeford lathes are driven through a friction clutch while the Montreal lathes have a clutch in the headstock and a friction pulley driven direct from the countershaft. The thrust-bearing is equipped with S K F ball bearings. The mandrel, which is of the short expanding type, has four rollers which grip the bore tight immediately the tool begins to cut. One roughing cut is taken the entire length of the shell. The tool used is "Stellite" welded tip, the cutting speed being 60 feet per minute with ⅛-inch feed. The rough turning reduces the outside diameter to 6.13 inches. Overhead runways and Wright hoists are installed for handling the shells between the tables and lathes. Production per machine per hour is 8.

Boring Operations

The fourth operation comprises the first and second rough bore and finish bore. Hepburn single purpose machines are used for this operation. They are equipped with Hyde air-operated chucks and S K F thrust bearings. The loose pulley is also equipped with S K F ball bearings. The first rough boring is done with a single pointed tool which roughs the straight part of the bore. The second rough boring is done with a boring-head, which roughs the bore, the contour and base. The third tool is similar to the second and it finishes the shell inside. The second and third boring bars have a straight cutter on the bar proper, while the end section or point carries the forming cutters for contour and base. Cutting lubricant is fed through each of the bars to the point. High speed steel is used for this operation, the speed for the roughing being about 60 feet per minute with a ⅛-inch feed. The bore is 4.24 inches in diameter after machining. Production about 15 per hour.

FORMING CHAMFER ON OPEN END OF 6-INCH SHELL

Rough Face Base

The fifth operation is cutting off the base, which is done on a number of cutting-off machines by various makers, principally the John S. Hall & Sons, Allatt Machine Tool Co., and T. H. Symington. These machines have universal chucks with a stop in the centre to fix the position of the shell. The lathe carriage is stationary and the cross slide carrying the tool post provides for the feed. A high speed steel tool is used for this work. Production 14 per hour.

Re-Centre

The base centre has been removed at the previous operation so the base has to be centred. The re-centreing is done on Le Blond lathes having expanding mandrels operated by Hyde air chucks. The tool holder or cross-slide holds a No. 5 combination drill and countersink. The drilling fixture is moved out of the way when putting the shell on the mandrel and then moved back to a central position. The feed is taken care of by the lathe carriage. In this case the shell rotates and the drill is stationary.

Second Rough Turn

Another rough turning operation now follows. This is the second and turns the shell concentric with the new centre. Le Blond and Davenport lathes are used on this work. The mandrel has self-tightening rollers, as used on the first rough turn. A "Stellite" tool is used at this operation, the speed being 90 feet per minute and feed ⅛ inch. The outside diameter is now 6.08 inches. Production 14 per hour.

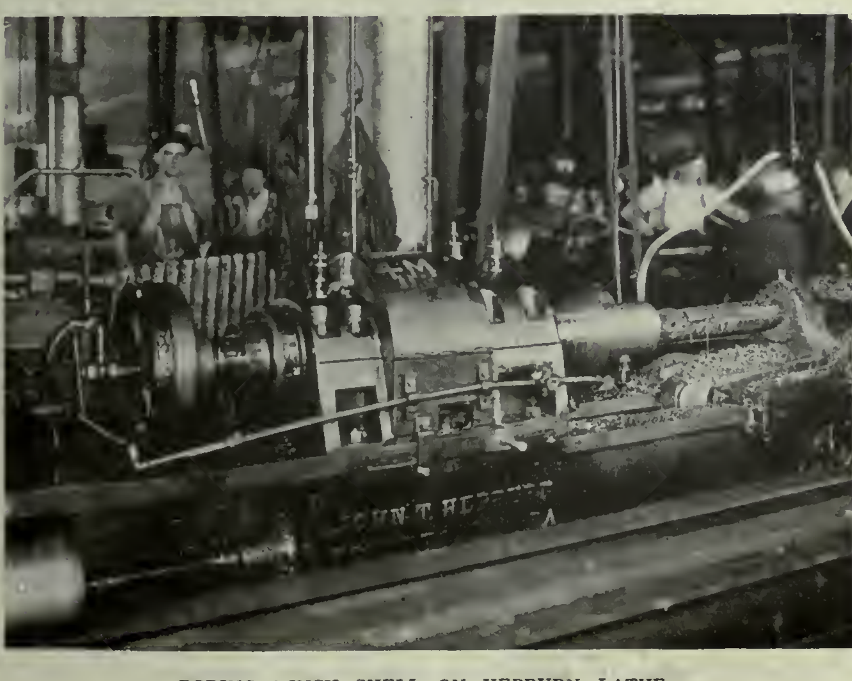
Chamfer Open End

At the eighth operation the open end is chamfered for about 2 inches down to relieve the nose for the forging. Hepburn lathes equipped with Hyde air chucks are used for this work. A fixture is mounted on the lathe carriage, having two tools, one is at an angle for hogging and forms the chamfer while the other is square and faces up the open end. The outside diameter of open end after chamfering is 5.14 inches. Production 60 per hour.

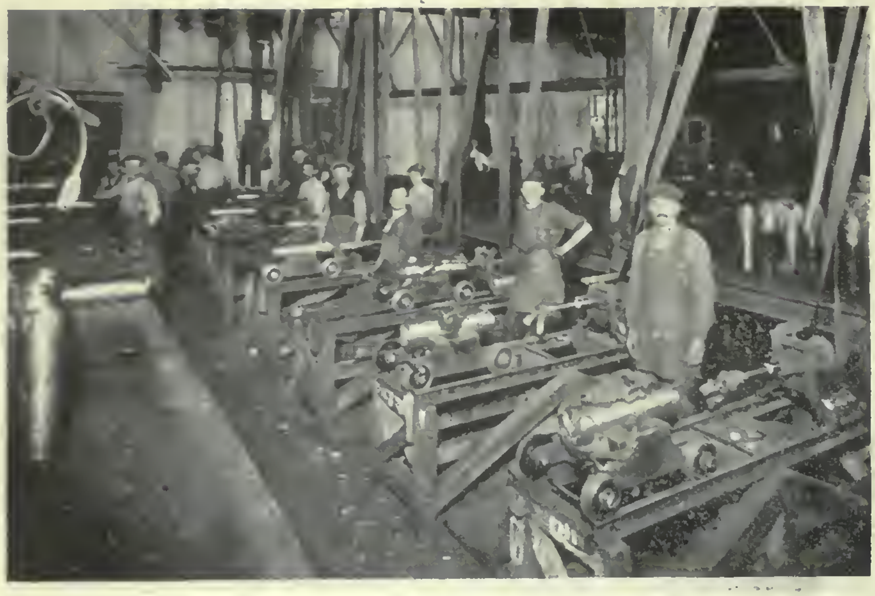
Buffing Bore

The continuity of the long table is at this point broken by a cross table. The shells which have been rolling from one operation to another, now are transferred to cross table and examined. A letter is also painted on the body to indicate more clearly the heat number. The heat number was transferred to the body from the base before the base was cut off at the fifth operation.

Near the cross table is a row of grinding machines for buffing the bore which is the ninth operation. The buffing machine has a long horizontal spindle, at the end of which are two short fingers, each holding a piece of abrasive material. The high speed of this



BORING 6-INCH SHELL ON HEPBURN LATHE.



BUFFING BORE 6-INCH SHELLS

spindle, 3,000 r.p.m., causes the fingers to fly out by centrifugal action. The internal buffing machines were built by the Roelofson Machine & Tool Co., Galt, Ont.

The shell which rests on a carriage fitted with roller-bearings is moved back and forth while the spindle is rotating and the bore being ground. This operation gives a smooth finish to the bore by removing tool marks. The spindles of these machines run in S K P ball-bearings and the countershaft is also equipped with these ball-bearings. The shells are then carried back to the cross bench and cleaned out.

Forging Nose

The tenth operation is forging the nose. In the "B" plant there are five "Mecol" six-hole furnaces, and three Perrin hydraulic presses. In "A" plant there are three "Mecol" furnaces and two Perrin presses. The pressure for these presses is supplied by a vertical, motor driven, triplex pump, built by the Canadian Boomer Boschert Press Co., Montreal. Accumulators are installed in connection with the presses and pumps. The furnaces are arranged in one row and have a gravity conveyor running the entire length in front. The shells roll from a table to the conveyor and are then pushed along the conveyor to the furnaces. The furnaces are oil-fired and the correct heat is judged by the appearance of the nose. Too much heat causes a coating of scale and too much air in the furnace will also produce the same result. If the nose is heated too far down it is liable to buckle when in the press.

The presses are situated in front of the furnaces and have an overhead runway. The shells are lifted from the furnace by tongs suspended from the runway and placed on the press table. The dies are in the head of the press and the table is pushed up by the ram underneath. When the nose has been forged the shells are carried by suspended tongs to a table. A continuation of the overhead system extends out into the machine shop and the shells are carried by tongs to another table where they remain until cool. The profile extends 6.28 inches from end of nose.

Ream and Seat Fuse Hole

A resumption is now made of the machining operations. The nose having been forged, the fuse hole can be machined. This operation is done on turret lathes or on engine lathes equipped with a turret. The machines used are LeBlond and Davenport lathes equipped with Hannifin air chucks.

The turret contains five high-speed steel tools. The first is a flat hogging drill for roughing the hole. The second is a single pointed tool for rough boring, while the third is a double cutter for forming the fuse seat bevel. The fourth is a single pointed tool for finishing boring the hole, while the fifth is a reamer for reaming the hole. The hole is 1⅝ inch diameter after this operation.

Finish Turn

The twelfth operation is finish turn on Le Blond, American and also Bridgeford axle lathes equipped with self-tightening mandrils, as used at the other turning operations. The profiling attachment is carried on brackets at the rear of the lathe. The brackets carry a shaft with a clamp attached, acting as a pivot for the radius bar which connects with the cross slide carrying the tool post. The tool starts cutting at the base end of shell and travels forward parallel to the shell up to the shoulder. During this time the carriage and profile attachment travel along together until the bar at the back comes up to a stop. When this bar hits the stop, profiling begins. The clamp being fixed to the bar remains stationary against the stop and therefore draws the tool post by means of the radius bar, thus forming the profile. The profiling attachment was developed at this plant. Before the shell is removed from the lathe the carriage is moved back to the base end, and the base diameter turned to 5.91 inches for a distance of 1½ inch from the base. The body is now 5.97 inches diameter outside. The radius of the outside profile is 11.92 inches. The tool used for this operation is "Stellite" 1 3/16 inch round and the cutting speed is 75 feet per minute, with 1/16 inch feed. Production 9 per hour.

Inside Profile

The thirteenth operation is forming the inside profile behind the nose. This is done on American lathes equipped with Hyde air chucks. A special tool is used for this work. It consists of a curved bar held in the tool holder, the bar having a curved high speed stetel cutter to form the profile to the required curve. The bar is put through fuse hole and fed up to the work by means of the cross slide upon which is the tool holder.

FURNACES AND PRESSES FOR CLOSING IN OPEN END AND FORMING NOSE OF SHELL

MACHINES FOR SANDBLASTING BASE OF 6-INCH SHELL

The radius of the profile is 11.92 inches. Production 8 per hour.

Rough Base Recess

Roughing the base recess and forming the radius is the fourteenth operation. The lathes used are principally Le Blond and Davenport equipped with Hannifin air chucks. There are also some Phoenix and Miller lathes equipped respectively with Hannifin and Hyde air chucks.

The tooling fixture is of special design and has two high speed steel tools. One is a square cutter for hogging out the base, while the other tool, which is close to it, forms the riveting strip and the radius. Production 15 per hour.

Finish Base Recess

This operation, the fifteenth, is similar to the preceding one except that the base recess only is machined. This is the finishing operation for the base recess which is ⅝ inch deep and 4.5 inch diameter. The machines used are practically the same as above but there is only one tool which is a plain high-speed steel cutter.

Copper Band Recess

At the next and sixteenth operation the recess, undercut and waves are formed for the copper band. Le Blond lathes with Hannifin air chucks are principally used for the operation. The fixture holding the tools is fastened to the lathe bed. The front tool forms the recess and waves, while the back tools form the undercut. The wave forming tool is oscillated by means of a cam on the chuck face, a spring being utilized to keep the roller on the fixture up to the cam. The back fixture has two undercutting tools which feed in at an angle of 20 degrees.

The feed for all the tools is taken care of by the lathe carriage. Attached to the carriage are two shaped bars, one for each fixture. As the carriage moves forward the bars cause the tools to travel in while cutting. When the waves and undercuts have been formed, a lever pivoted to the back fixture and carrying a small cutter, is brought over to clear up the recess. There are two waved ribs ¼ inch apart, and the recess on the outside is .67 inch wide and 8 inches from the base. The wave ribs have an angle of 70 degrees. Production 38 per hour.

Nose Recess

The seventeenth operation is forming the recess in nose behind the threads. The recess is 2 inches diameter and about .14 inch wide. The operation is performed on Le Blond lathes equipped with air chucks. A bar in the tool holder has a small high speed steel tool at the end for cutting the recess. Production 50 per hour.

Threading Fuse Hole

The eighteenth operation, threading the fuse hole, is done on Holden-Morgen and Cowan thread milling machines. The shell is put into the head of machine from the back and the cover fastened on. The milling hob is on a separate fixture, with independent drive. The shell makes one revolution while the threads are being cut. A high speed steel hob is used and the cutting speed is 75 feet per minute. The threads are 14 to the inch, right hand. Production 20 per hour.

Sand Blast

At this stage the shells are washed in a solution of soda and hot water to remove the grease, etc. They are then laid in a horizontal position on revolving rollers and dried with compressed air.

The next operation, No. 20, is sand-blasting the bore. A number of machines built by the Gray Mfg. Co., Toronto, are installed for this operation. The shell is held in a fixture nose down and slowly rotated while the sand blast is injected from below. Sand-blasting removes the tool marks and gives a smooth finish to the inside of shell.

The shells now undergo the preliminary Government inspection, all the shells being carefully examined, gauged and weighed.

Base Plate

The base plate which is riveted into

RIVETTING BASE PLATE WITH AIR HAMMER

FINISHING BASE RECESS AND FORMING RIVETING STRIP.

the shell base is a drop forging 4½ inches diameter and ½ inch thick. The base plates are turned up and faced on Davenport lathes equipped with air chucks, in two operations. At the first, the diameter is turned and bevel formed while at the second the plate is faced. When turning the diameter the plate is held up tight by pressure from the tail centre, against a knurled driving plate. When the plate is being faced it is held in a chuck. Davenport and American lathes are used principally for this operation. The base plates are fitted in the base recess after the preliminary Government inspection.

Copper Band

The shells are rolled along the table to have the copper band put in the recess prior to being pressed in. They then go to the presses.

The copper band presses were built by the West Tire Setter Co., and are operated by hydraulic power. An eye bolt is screwed into the fuse hole and the shell is lifted from the table to the press by a chain hoist. A pressure of about 1,300 pounds is applied twice, the shell being moved round between each application. The shell is then lifted out and rolled along the table to the base rivetting machines.

Rivet Base Plate

Rivetting the base plate is the twentieth operation, which is done on a machine built by the Roelofson Machine & Tool Co., Galt, Ont., from suggestions furnished by the firm to whom the machine was supplied. The machine is similar in design to the copper band turning machine built by the same concern, but it has one or two special features embodied in its construction. The spindle has a worm gear drive and is fitted with a quick acting collet chuck. The spindle rotates at 10 r.p.m. The machine has a fixture on the bed for holding the air hammer at the required angle. During the first two revolutions the strip on the base is rivetted over. The hammer is then moved in a short way and the operation completed. A feature of the machine is the accuracy obtained in the method of holding and operating the air hammer.

Face Base

The bases are now faced up, twenty-sixth operation, on a row of "American" lathes equipped with air chucks, an ordinary facing tool being used.

The shells then travel along the table, pass over the scales, and are weighed. The mean weight of shell at this stage is 85 pounds, 12 ounces, the high being 86 pounds 3 ounces and low 84 pounds 14 ounces.

The following marks are then stamped on the base: 6-in. H. R. XIII. L., date, and firm's initials. The heat number is stamped on the body.

Tap Fuse Hole and Reseat

A number of minor operations now follow, the first being to tap the fuse hole, which is done with a hand tap. The fuse seat is then finished on a drill press, having a special reseating tool. The fuse hole is then retapped.

The shells are again washed in a solution of soda and hot water and dried by compressed air while being revolved on rollers fitted into the table. A Gray sand blast machine is installed in this department for removing varnish from the shell bore if they have failed to pass inspection after varnishing.

Varnish and Bake

When the shell is being varnished it is laid on revolving rollers fitted in the table, sprayed inside with varnish and brushed. Only a very thin coat of shellac varnish is applied.

The shells are then baked for two hours at a temperature of 400 degrees. The oven, which is heated by electricity will hold three trucks or a total of 80 shells at a time. The shells are placed on the trucks, which are mounted on wheels, and placed in the oven. When the baking process has been completed the shells are removed to a table to cool off. The varnish is then inspected. A "Tycos" electric contact type pyrometer is installed in connection with the baking oven.

Turn Copper Band

When the shells are cool and the threads and container seat have been cleaned, they are moved along to have the copper band turned. This operation is done in a Roelofson Machine Tool Co. band turning machine. The forming tool is held in a tool post at the front, and the band is finished with a hand-turning tool. The hand tool removes the burrs at the side of band down to the shell body. The production is 120 per hour.

The final inspection is made after the copper band has been turned. This is a Government inspection and all the shells are carefully gauged, weighed and examined. A plug is screwed in the fuse hole and the shells are then greased and packed two in a box.

The final weights are as follows: High 85 lbs., 15 oz. 2 drs.; mean, 85 lbs., 8 oz., and low, 84 lbs. 10 oz. 11 drs., the tolerance is thus about 1 lb. 4½ oz. The mean weight after the inside profile has been formed is 87 lbs., 4 oz., and at the preliminary inspection the mean weight is 82 lbs., 11 oz. The base plate weighs 2 lbs. 1 oz. finished, and the copper band 18 oz. rough and 12 oz. fin-

TURNING COPPER BAND 6-INCH SHELL

ished. The shells go through the various operations in series of 300. There is no tensile test for 6-in.shells, but two shells are taken from each series, one which is cut up in four sections and one proof shell for the firing test. The test shells are taken out at the final inspection.

CUTTING TEST PIECES FROM SHELLS

A new machine for cutting test pieces from shells by means of an oxy-acetylene torch, has been developed and put on the market by the W. R. Carter Welding Co., York street, Hamilton, Ont. The machine is being built for 6-inch, 9.2-inch and 12-inch shells.

The frame of the machine consists of angles welded together, forming a stand for carrying the shell and cutting outfit. As will be seen from the illustration, the oxy-acetylene torch is carried on a fixture which can be moved lengthways on the machine as well as across. The fixture is traversed by means of a screw and handwheel.

The shell as shown in the illustration is resting on longitudinal rollers revolved by the crank through gears. The test piece is first cut out from the shell body as shown, the fixture carrying torch travelling along while cutting in a longitudinal direction. When cutting across, the shell is turned by means of the crank, while the torch is in operation. While the base is being cut off the torch is stationary and the shell is turned round. The complete operation has been done in four minutes.

WOMAN IN WORKSHOPS

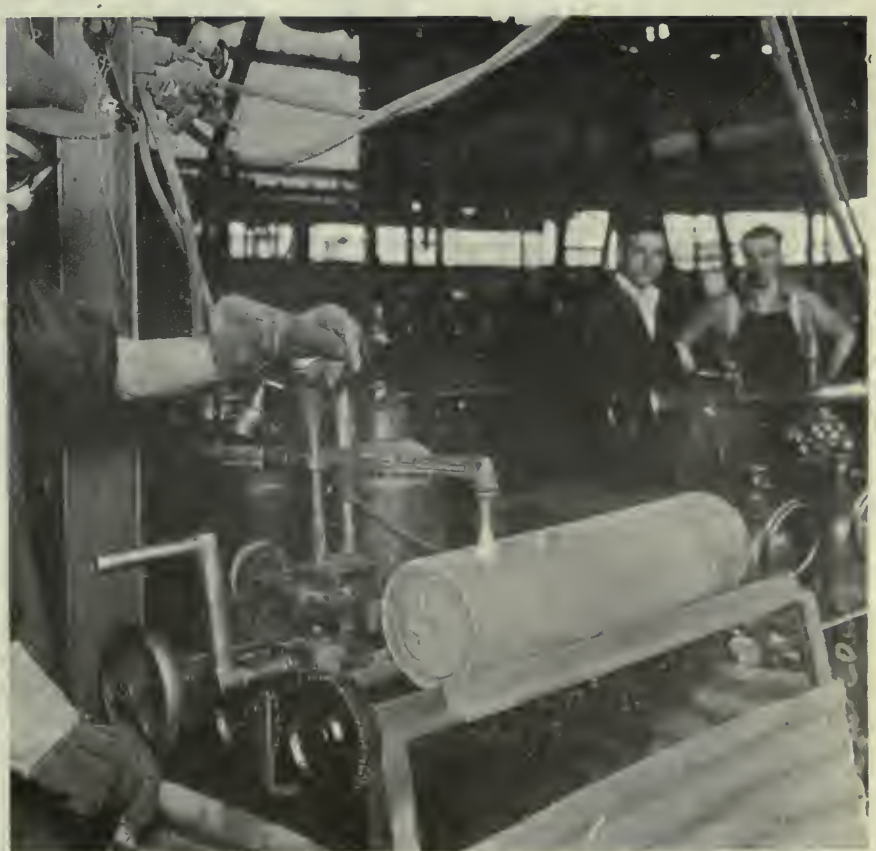
By R. E. D.

There is very little attention being paid to the future of female labor in engineering, although it is generally admitted that it will be one of the most difficult problems we shall have to solve during the period of reconstruction. It is surprising that women were not engaged in engineering before the war considering that they were employed in many industries that were manifestly less suited to them; but there is some consolation in the thought that insular conservatism was not responsible for this, as even in Germany their value was not realized until some sufficient male labor could not be had. They have become so important a part of the producing machine now that it is difficult to see how they can be ejected from it when the most pressing need for their labor is past. This is looking at it from the purely economic standpoint and ignoring the social danger that would be incurred by throwing these women on the labor market. Many of them will return to their domestic duties when their husbands return from the army, but many more will desire to make their new vocation their life work, and it is in the interests of industry that they should be allowed to do so. But their sphere of usefulness is limited, and their greatest value is not realized when they are employed at work for which they are unsuited. For example, girls or women may be useful in the coreshop, but the heavy labor of the foundry floor is the man's work. It would have been a wise policy if, when it was first determined to introduce women into the engineering workshops, a committee of experts had been appointed to consider any advice on the best method of training them for suitable classes of work. We might now have had a great army of really skilled women workers who would have released more men for the colors.

It is erroneous to suppose that the only opponent of woman labor is the skilled male worker. The foremen's opposition has been potent during the war. The workman's prejudice is logical, and is usually based on the fear of undercutting. The history of woman in industry is not pleasant reading. Invariably she has been used to keep down the rate of wages, and consequently, lower the living standard. The only way to eliminate the risk is to abolish sex rivalry. If workmen would open their unions to woman, they would find them loyal members of their craft. It may be admitted, however, that women in certain work require more help, because of the physical weakness, than men, and it may thus be economical to an employer to pay them the same rate of wages as men. This difficulty could be adjusted amicably. however, between the workers and employers in conference.

The war period has seen new developments in engineering. The petrol engine has advanced wonderfully, and the manufacture of aeroplanes, while it is not likely that it will continue in its present conditions or proportions, is a permanent addition to engineering activity. It is probable that it is in motor car and aeroplane work that women will score her greatest successes. although even in the general works there is room for her. It will be interesting to observe the effect of women's entrance into engineering shops on workshop conditions. She enters with a mind unbiased and unbittered by the memories of industrial struggles and unprejudiced by worn out customs. Women may be inherently no more conscientious than men, but the "ca canny" policy is not likely to be favored by them; indeed, it is more a disease than a policy, a disease which has become chronic because of the stupid relations between employers and men in the past. Apart altogether from their influence on wages, however, it is probable they will demonstrate a zeal of reforms effecting the hygiene and sanitary conditions of the shops, which will make for efficiency and, consequently, increased productivity.

ACCURACY is a prime factor of conservation. An American engineer stated recently that he had seen a British plant employing eleven thousand persons making over American-made fuses.



CUTTING TEST PIECE FROM SHELL FORGING BY OXY-ACETYLENE TORCH.

The Chemist and Metallurgist in the Munitions Industry

Growth of Munitions Industry Stimulates Demand for the Technically Trained Man—Particularly so in Chemical and Metallurgical Fields—Every Plant of Sufficient Size Now Recognizes Need for Skilled Supervision of All Plant Processes

By F. E. Gardiner

Chief chemist and Metallurgist for the Dominion Bridge Co., and the Dominion Copper Products Co.

THE marvelous growth of the munitions industtry in Canada during the past three years has ed to an ever-increasing demand for men of technical training along chemical and metallurgical lines. Before the war it was the exception rather than the rule to see men of this training employed, even in the large industrial plants; to-day almost every plant engaged in any form of munition activity employs at least one man thoroughly trained in chemical and metallurgical practice. The duties of the works' chemist and metallurgist are many and varied, depending on the work in which his engaged, as well as the laboratory facilities at his disposal.

CHEMICAL LABORATORY AT DOM. BRIDGE CO.

Since the spring of 1915, when they first embarked on their munitions activities, the Dominion Bridge Co. and the Dominion Copper Products Co. have manufactured a wide variety of products. All sizes of shells, from the 18 pounder shrapnel to the 9.2 high explosive shell, British, Russian and Belgian cartridge cases, copper driving bands from 3 inch to 9.2 inch, marine engines and boilers, brass and copper tubes and sheets, and miscellaneous smaller components of many kinds, have been some of the munition products which have been manufactured at these plants. Looking at the question from the light of their experience I will endeavor to show in a general way the part the metallurgist plays in the different operations which go to make up the finished product. The same work that is carried on by the metallurgical department in the plants of these two companies, will be carried on to a greater or lesser extent in any of our large munition plants.

The general work of the chemist will lie along the following lines:

1. Chemical analysis of raw materials or finished product.
2. Supervision and regulation over all heat treatment necessary to produce the finished product.
3. Physical testing of all materials, both in course of manufacture and as a finished product.
4. Microscopic examination of the various materials used.
5. Miscellaneous testing and experimental work.

Heat Treatment of 75 m.m. U. S. Shells

The specifications laid down for nearly all shells of a small calibre call for them to be heat treated, after which they must satisfy certain physical requirements. The United States 75 m.m. shell after treatment has to have an elastic limit of 45,000 lbs. per in., an ultimate tensile strength of 90,000 lbs. per sq. in., and an elongation of 15 per cent.

In heat treating steel to achieve any desired result it is a great advantage to know beforehand the chemical composition of the steel. Here is where the chemist comes in. He makes an analysis of the steel and passes it on to the metallurgist who uses this information as his experience directs. In hardening shells of any kind the following are the main factors influencing the success of the operation.

1. Uniform heat to the correct temperature.
2. Good quenching medium, kept at a low temperature.
3. Uniform tempering to the correct temperature.

The failure to observe any of these three factors will often lead to a failure in the steel and cause serious delays in the production of the shop, to say nothing of the additional cost of retreatment.

Uniformity of heating is dependent on several conditions, chief of which are the nature of the furnace used, the kind of fuel, and the efficiency of the labor. As a general thing it may be said that large furnaces of the automatic and mechanical types, using either oil or gas as a fuel, will give better and more uniform results than the smaller furnaces of the batch type. Their radiation losses will also be much smaller and thus lead to increased efficiency and lower fuel costs in operation. However excellent results can be secured from the batch type of furnace also, although these results are—to a much greater degree than in the case of the larger type of furnace — dependent upon the care and supervision exercised over their operation as well as the quality of the labor operating them.

Another factor that greatly influences the uniformity of heating is the use of pyrometers. Any good rugged thermocouple of the base metal type used with a high resistance indicator is suitable, and it will be found that once the men get accustomed to working by pyrometer control, using their judgment as to time and color as a check against the pyrometer readings, very uniform and successful hardening will result.

A good quenching oil should have a high flash point, high thermal conductivity, a low volatility, good specific gravity, and uniform viscosity. A well blended fish and mineral oil possessing a flash point of 400 degrees Fahr. and a specific gravity of about .900, will generally be found to meet these requirements. The reason for keeping the oil at as low a temperature as possible is something that is obvious to everyone. An oil that is continually kept at a high temperature suffers a great decrease in quenching power and is bound to distil off a certain fraction of its lighter and more volatile constituents, leaving the heavier ones behind, which still further lessens its effectiveness.

The correct temperature for hardening and tempering sheel steel depends upon its critical point, which is determined by the percentage of carbon present. In general, the lower in carbon the steel is the higher the temperature it is raised to for hardening, and the lower the temperature it is drawn back to. The range of temperature that we have found to give good results in hardening 75 m.m. shells varies from 1,500 to 1,575 degrees Fahr., according to the carbon content, and the tempering range from 950 to 1,100 degrees Fahr.; the carbon content of steel treated under these conditions has varied all the way from .35 to .55 per cent.

Forging 6 Inch and 9.2 Inch Shells

Another branch of the munitions industry in which great strides have been made is the manufacture of shell forgings. All sizes of shells from the 18 pounder weighing only 25 lbs. in the rough, to the big 9.2 inch shell weighing 375 lbs. have been successfully forged in this country. The Dominion Bridge Company have been forging the 6 inch high explosive shell for the Imperial Munitions Board for the past two years and are now making 9.2 inch forgings for the American government. The billets are heated in underfired furnaces equipped with Ferguson burners and use oil as a fuel, and are subsequently pierced on 700 ton Southwark hydraulic presses. After forging the shells must pass certain physical tests.

The British specifications for forgings of this size call for a yield point of not less than 19 long tons per sq. in., a tensile strength of from 35 to 49 tons, and a minimum elongation of 17 per cent. Needless to say these requirements are not always met with, so that a subsequent treatment of the steel is very often necessary.

The chief cause of failure will usually be found in the overheating of the steel before forging, and it is very hard to make the average heater realize the great effect that any severe overheating has upon the physical properties of the steel. Constant supervision and care over the heating of the billets is the chief essential to successful forging work. Billets which have been slowly and uniformly heated to a temperature of from 1,900 to 2,000 degrees Fahr. will be found to forge just as easily as those whose heating has been hastened and which emerge from the furnace dripping at a temperature anywhere up to 2,300 degrees Fahr. Not only will the correctly heated billet forge just as readily as the overheated one but the results from its physical tests will be immeasurably superior and the steel will have a very much better structure. Knowing the analysis of the steel we can often greatly affect its physical properties by the method of cooling after forging. Cool high carbon steels as slowly as possible, the reverse for low carbon ones.

For purposes of heat treating the forgings which fail to pass the tests may be classified as follows:

Forgings failing in yield or tensile.
Forgings which fail in elongation.
Forgings which exceed the high tensile limit.

The failures of forgings from the first cause may generally be ascribed to overheating, but it often happens that the steel is so low in carbon that the ordinary methods of cooling after forging are not sufficiently rapid to enable it to pass the physical tests even if it has been forged at the proper temperature. The steel in any forging whose failure has been due to overheating alone can usually be brought into a condition which will enable it to pass the test, by the heat treatment known as "normalizing." This merely consists of heating the forgings slowly and evenly to a temperature, well above their critical range and holding them at this temperature for a length of time which depends upon the severity of their previous treatment, and the results of their first physical tests, removing them from the furnace, standing them on end to cool, as far apart as possible, and allowing a good circulation of air to pass around them. A temperature of 1,550 degrees Fahr. will be found to be good average practice for this operation, which should be carried on as a continuous one, if possible.

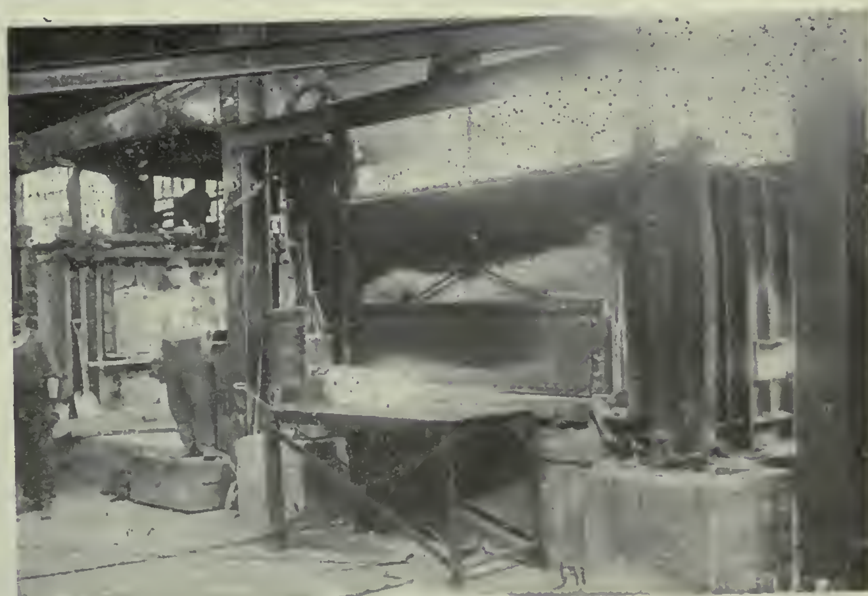
Those forgings whose failure is due to a combination of low carbon and overheating will require a quicker cooling than that given by the normalizing treatment. This treatment is known as "air cooling," and as its name implies, it cools the forging by the artificial use of air. The apparatus used for this purpose differs in construction in almost every plant using it, but in the main its general features are the same. The apparatus designed and adopted by the Dominion Bridge Company cools four 6 inch forgings every 9 minutes and consists in essential, of an inner pipe of 3 inches diameter, which enters the shell, and an outer casing of 8 inches diameter into which the shell slides. The outer casing is hinged so that when the shell enters, the hinged section is clamped down and the air blast turned on. The air used is at a pressure of about 8 ounces, and is supplied by a No. 9 Sturtevant blower. The temperature of the shell as it enters the apparatus, varies from 1,550 to 1,660 degrees and its cools in 9 minutes to about 600 degrees Fahr.

The results achieved by the use of this appliance are very good and the tensile strength can often be raised anywhere from 2 to 8 tons, with a corresponding increase in yield. This plant has successfully treated steel by this method, as low as .35 per cent. carbon.

Failure in elongation is usually caused by overheating, but also may be due to forging at too low a temperature. This latter condition, however, is seldom met with in everyday forging practice. Another cause of low elongation is to be found in the nature of the steel itself, flaws often appearing in the fractured test bars. It is almost impossible to do anything with steel whose failure is due to flaws, but where the failure in elongation has been caused by overheating, the steel will usually respond to the normalizing treatment, or if not, to a light anneal.

Failures on account of high tensile can generally be traced to the high percentage of the hardening elements, carbon and manganese in the steel, to overheating or to a combination of both. In order to lower the tensile strength of a steel it is necessary to retard the speed of cooling, or in other words to anneal it. For steel possessing very high physical properties, with a high percentage of carbon and manganese, furnace cooling may be necessary, but as this is a very expensive proposition and also greatly slows up production, it is only resorted to in cases of extreme necessity. Removing the forgings quickly from the furnace after they have reached and been held at the desired temperature long enough, piling them in layers in an iron box or pit, carefully protecting them from all drafts, and covering them with a heavy layer of ashes, will invariably be found to give the desired results. The tensile strength may easily be lowered 5 tons by this method of treatment and production will not be held up as in the case of furnace cooling.

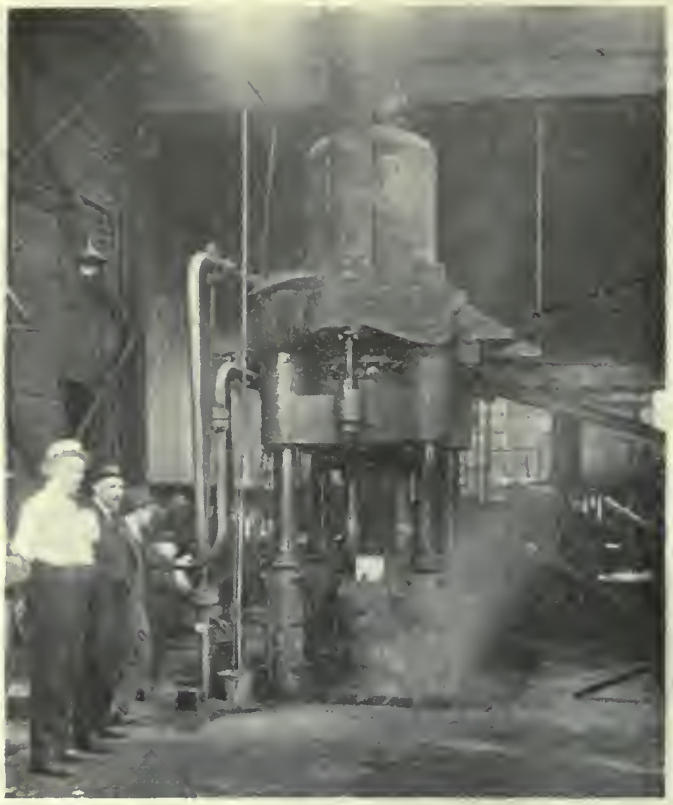
In treating forgings by any of the above processes, it is needless to say that a knowledge of the chemical analysis of the steel treated, as well as the result of its previous physical test, is necessary to achieve the best results. Careful temperature control, which can only be obtained by good pyrometer regulation is also very essential.



HEATED 9.2 BILLET EMERGING FROM THE FURNACE.

Treatment of Marine Engine Forgings

The building of marine engines is another new industry to a large number of plants in this country. Every marine



FORGING 9.2 SHELLS AT THE PLANT OF THE DOMINION BRIDGE CO.

engine has to have a large number of its parts, such as connecting rods, piston rods, crank shafts, etc. made out of forged steel. These forgings all have to be annealed and have to meet very exacting physical requirements. Take for instance Lloyd's specifications for marine engine forgings. These specifications call for a tensile strength of from 28 to 32 tons per sq. in., area of the test piece being ¼ inch, with a minimum elongation of 25 per cent. over 2 inches for steel of 32 tons tensile, and 29 per cent. for steel of 28 tons tensile. In addition to this tensile test a bar cut from the test coupon of section 1 inch by ¾ inch, must stand bending cold through an angle of 180 degrees.

A steel that will conform to these rigid requirements is not always easily attained owing to the enormous and ever increasing demands upon the steel mills. Such being the case, it is the duty of the metallurgist to use whatever steel he can obtain, if it has any chance at all of passing specifications, and endeavor to put this steel in such a condition after forging, by an intelligent application of the rules of steel heat treatment, that it will conform to the required physical requirements. Generally speaking, when a steel of any given carbon content possesses its lowet tenile properties, it also possesses its maximum, or very nearly its maximum, ductility. Thus, if we are using a steel whose carbon content is on the high side, this steel must be annealed very carefully, and slowly cooled, in order to meet the physical requirements as given above.

Slow cooling, especially through the critical range of the steel, enables the maximum amount of ferrite, or pure iron crystals to separate out from the iron-carbon alloys, and this gives us the results we are after; that is, low tensile strength and high ductility. Sometimes even this treatment will not enable the steel to successfully pass the bend test, in which case a double annealing may be resorted to. This consists in heating the steel well above its critical range, say to 1,500 degrees Fahr., slowly cooling in the furnace to 1,200 degrees, reheating to just under the above critical point, which depends upon the carbon content of the steel, but is generally in the neighborhood of 1,350 degrees, and then allowing the steel to cool in the furnace. This treatment will invariably raise the tensile a little, but gives the steel great ductility and cold bending properties. The steel also shows a large reduction of area and breaks with a well cupped silky fracture.

Steel low in carbon should not be given such a thorough anneal and should be allowed to cool in the air whenever possible. Our own experience has been that any steel ranging from .25 to .35 carbon. and from .40 to .80 manganese, will meet these requirements if intelligently handled. A steel that will always give good satisfaction for marine engine work would be one of .30 carbon and .50 manganese. If a steel of this composition is carefully annealed at from 1,450 to 1,500 degrees its physical properties will always be found to come within the limits laid down above.

The method of handling any forging work of this character in use at the plant of the Dominion Bridge Company is as follows: Every billet which comes into the shop is numbered consecutively, drillings taken and a chemical analysis made. When forgings are made from this particular billet, the original billet number is stamped on each forging and also on the test coupon, which is left on the end of one of the forgings made from every billet. In this way one test covers all forgings made from the same billet and all duplications of testing is thus avoided. The forgings are grouped together in the annealing charge, according to the chemical composition of the billet from which they were made, and all forgings of approximately the same chemical composition are annealed together and receive identical treatment.

Cast House Practice of the Dominion Copper Products Co.

Passing now from the ferrous branch of metallurgical operations as examplified by the products of the Dominion Bridge Co., we come to the non-ferrous field in the Dominion Copper Products Co. From a metallurgical standpoint one of the chief differences between steel and the non-ferrous metals and alloys such as copper and brass, is the fact that we can bring steel from a dead soft to a glass hard condition by simply heating it above its critical point and quenching it in water. Such is not the case with copper or brass. In order to harden either of these metals it is necessary to change their structure by the application of some mechanical strain, and the

FURNACE USED FOR HEAT TREATMENT OF FORGINGS SHOWING AIR COOLING APPARATUS IN PLACE.

CASTING BRASS TUBES IN CAST-HOUSE OF DOMINION COPPER PRODUCTS CO.

greater this strain is the harder the metal becomes, with a consequent decrease in ductility.

In any copper or brass rolling mill the first place where any chemical or metallurgical work occurs, is in the cast house, where the different alloys are made. The raw materials that enter into the composition of the different alloys are first carefully sampled and analysed to insure that no foreign elements are added to the alloys by impurities existing in the virgin metals. Copper, zinc, tin and lead, are the chief metals used in rolling mill alloys. After the virgin metals have satisfied the chemical requirements, the charge for any given alloy is weighed out into pans and conveyed to the cast house to be melted and cast into different kinds of moulds. The furnaces used for melting at the plant of the Dominion Copper Products Co. are of the pit fired type, the fire chambers being 15 by 15 inches in cross sectional area, with a grate at the bottom on which the fuel and the crucibles rest. The fuel used is anthracite coal and the draft for combustion is supplied by stacks 86 feet high and 2 feet 8 inches in diameter, each stack supplying 20 fires.

The charge is melted in graphite crucibles of different sizes, holding from 160 to 220 lbs. In making ordinary cartridge brass the procedure is as follows: The scrap is placed in the bottom of the crucible and the copper ingots are laid on its rim to heat up. After the scrap has melted, about a handful of coarse salt is added, then the copper, and the charge is completely covered with charcoal. When the copper has melted the spelter is added little by little about 10 or 15 minutes before pouring. The average time for a charge of 200 lbs., including charging, melting and casting, is about two hours. The molten charge is then poured into moulds and allowed to cool.

The chief alloys made are Muntz metal, an alloy of 60 per cent. copper and 40 per cent. zinc, used chiefly for condenser heads and tubes made by the hot piercing process; Admiralty metal, 70 per cent. copper, 29 per cent zinc, and 1 per cent. tin, used for condenser tubes on account of its great resistance to corrosion; cartridge brass, 70 per cent. copper and 30 per cent. zinc; 2 and 1 brass, as its name implies, an alloy containing 2 parts of copper and 1 of zinc; and several kinds of bronzes which generally contain varying amounts of tin in addition to the copper and zinc.

In order to insure uniformity of product it is necessary that frequent samples of the various mixtures cast be taken daily. This is done by the foreman caster, who marks the number of the mixture on the sample button, and it is then sent to the laboratory and analyzed. Any variation from the desired analysis is rectified by changing the mixture, in this way the different alloys are cast to a composition very closely approximating that desired.

One of the main objections towards the melting of copper and zinc alloys in fuel fired furnaces is the unsanitary conditions existing in the cast house, especially in the summer months, and the consequent inability of the plant to keep experienced help. Other objections are to be found in the high cost of fuel, crucibles and labor, and the high metal losses, generally due to the volatilization of the zinc. All these facts contribute to a feeling among brass men that a solution of these difficulties will be found in the electric furnace. Numerous electric furnaces have been tried out in the various mills of the United States during the past two years. The experience derived from these different experimental furnaces has seemed to show that an electric furnace of the induction type is best suited for the melting of these brasses high in zinc. This type of furnace is capable of very accurate heat control, has a high thermal efficiency, and keeps the metallic losses down to a very low point. The Dominion Copper Products Co. is at present installing an induction furnace of the Foley type, having a melting capacity of 1,000 lbs. per hour. The electric furnace as applied to brass melting is only in its infancy, but if it meets with anything like the same success that it has in the steel industry it will eventually find a very wide application in the non-ferrous field.

Copper Refining Furnaces

In any rolling mill handling copper there is always large scrap accumulations which it is not economical to return to the cast house for remelting. Such products are usually in the form of light turnings, metal recovered from cast house ashes, mill sweepings, black copper from the cupola and miscellaneous copper scrap of all kinds. To handle this metal, as well as other metal they receive from outside sources, the Dominion Copper Products Co. have two copper refining furnaces of 15 and 25 tons capacity per 24 hours. These furnaces are of the ordinary reverberatory type, fired by

CASTING COPPER SLABS.

soft coal. They are set up on cast iron plates resting on brick piers, and the bottom and the inside of the furnace which come in contact with the molten copper, are made of silica brick. The draft is supplied to each furnace by meaus of a brick-lined flue of two feet interior diameter, which leads into a 60-foot firebrick-lined stack, of three feet interior diameter.

A charge is tapped from each furnace every 24 hours and the refined copper is either cast into ingots for use in the cast house, bowl cakes to be drawn out into tubes or bands, or cake copper to be rolled out into sheets. The moulds are placed on a circular rack revolving about a central post by which it is supported. The molten copper is tapped from the furnace into a clay-lined tilting spout, and from there into the moulds.

A typical analysis of the copper which comes from these furnaces would be. copper 99.87 per cent., oxygen 0.08 per cent., other impurities 0.05 per cent. This percentage of oxygen which exists in copper in the form of cuprous oxide, is necessary, as it enables the copper to be cast free from blowholes and also checks the ill-effects of any other impurities which may be present in the copper. Copper containing this amount of oxygen is in its "tough pitch" condition, and it is in this state that it exhibits its best physical properties. When fractured it should show a rose pink color and have a silky structure.

During the process of refining copper considerable slag is made, the amount and composition of this slag depending to a great extent on the nature of the charge to be refined. The following is a typical analysis of a refined slag: Copper, 40.0 per cent.; silica, 29.5 per cent.; iron, 9.4 per cent.; lime, 2.5 per cent.

As will be seen from the analysis this material is very high in copper and consequently of considerable value.

BACK VIEW OF THE 15-TON FURNACE SHOWING CHARGING FLOOR.

Black Copper From the Cupola

The next step in the scheme of metallurgical operations is therefore to recover this copper from the slag. This is done by smelting the slag in a cupola, using coke as a fuel and roasted pyrites and limestone as a flux. Besides the refining copper and fluxes, the charge usually consists of mill sweepings, fine material recovered from the cast house ashes, ashes from the cupola flue, and old bricks from the worn out refining furnace linings which are generally impregnated with copper to a considerable extent. These various materials are weighed and charged into the cupola in regular sequence, as many as 75 charges being melted down in 24 hours, and from 5 to 7 tons of black copper averaging 95 per cent copper recovered per day. This material goes back to the refining furnace and completes the cycle of operations.

Daily analyses are made of the slag from the cupola. This is necessary in order to keep it of the proper composition to get the requisite degree of fluidity, and the right fluxing action to insure a good copper recovery. The fluxes that are used are also sampled and analysed as any considerable amount of impurities present in them would have deleterious effects upon the melting operations. For instance, the occurrence of much alumina in the limestone with the presence of much sulphur in the pyrite under would form a quantity of copper matte which would lead to considerable trouble in the subsequent refining.

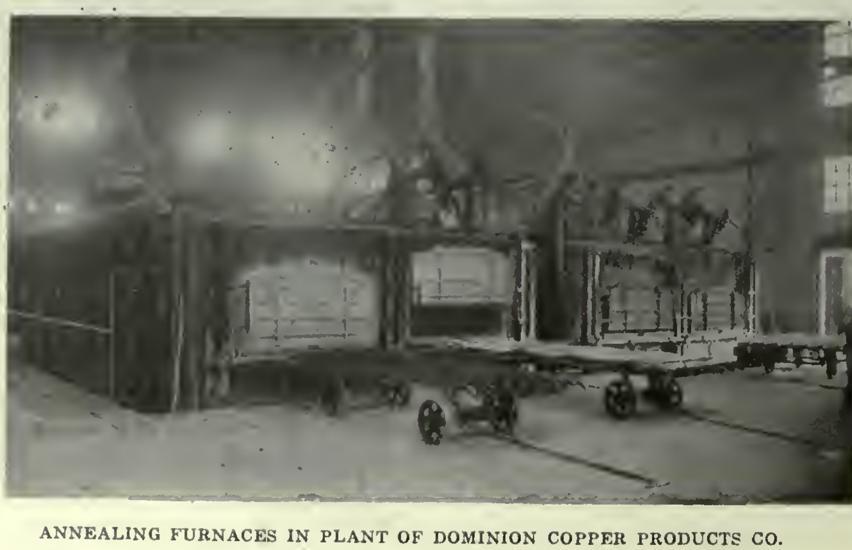
Annealing of Brass and Copper

Another part of the metallurgist's work in a brass rolling mill deals with the annealing of the material in the process of manufacture. After a certain amount of work has been accomplished on either brass or copper it is necessary to anneal it before more work can be performed. Annealing changes the highly distorted and elongated structure of rolled brass to a uniform crystalline structure and the metal becomes soft and ductile. The temperature and time of annealing depends upon the previous work performed on the brass and also upon the degree of softness required. To anneal brass or copper to a dead soft condition a uniform heat of from 1,200 to 1,250 degrees Fahr. will usually be found to be sufficient. The same applies to the heat treatment of brass as to that for steel, namely, that good temperature control cannot be effected without the use of accurate pyrometers.

The annealing furnaces in use at the plant of the Dominion Copper Products Co. are of the underfired type, using oil as a fuel. The material to be annealed is loaded upon sheet iron pans, drawn into the furnace by long hooks, passes through the furnace and out at the opposite end where it is either sprinkled with water or left to cool by standing in the air.

Microscopic Examination of the Metals

The foregoing resume of the everyday work of the plant chemist and metallurgist has dealt with his work mainly from a strictly chemical and metallurgical standpoint. Another branch of work which comes within the field of the met-



ANNEALING FURNACES IN PLANT OF DOMINION COPPER PRODUCTS CO.

TAPPING BLACK COPPER FROM THE CUPOLA, DOMINION COPPER PRODUCTS CO.

allurgist and in which great strides have been made during the past few years, is the science of metallography or the microscopic examination of metals. By means of this science the metallurgist is able to ascertain if the treatment he has given any metal in process of manufacture has achieved the desired results and imparted to the metal that structure which it must have if it is to meet the requisite physical tests. A microscopic examination of a piece of metal, steel or brass, will often give the metallurgist information which it might take days to find out by other means. Not only will it justify or condemn the accuracy of his treatment but it will often locate for him causes of failure or deterioration in metals which could never be detected by ordinary chemical or physical examination.

A case in point came up at the plant of the Dominion Bridge Co. a short time ago. Several furnace plates which were used in the construction of marine engine boilers, when heated and flanged, showed serious cracks and flaws in the steel. At first sight these defects looked as if they might be due to overheating or to red shortness in the steel due to a high sulphur content. A chemical analysis showed the sulphur to be low and a physical test cut from the portion of the steel adjacent to the cracks gave results well within the limits for a steel of that quality. A specimen that contained several cracks was then polished, etched and examined under the microscope. The structure of the steel was good and no signs of overheating were in evidence. Finally about 1-32 was filed off the face of the specimen and it was repolished. An examination then disclosed the cause of the failure. Embedded in the steel were particles of slag and all around the edges of the cracks broken up particles of slag could be seen, showing that these cracks had all taken place where the larger slag particles had originally existed in the steel. This is only one instance of the use of the microscope for the examination of metals.

Physical Testing and Miscellaneous Work

In the larger munition plants the metallurgist generally also performs the duties of a testing engineer. He carries out all the tensile, compression, bend and any other tests called for in the specifications for the finished product. A well equipped testing laboratory where physical tests can be made at a moment's notice will often save the manufacturer considerable money, especially at the beginning of a new industry when things are generally more or less in the experimental stage.

Other tests which the works chemist may be called upon to make include the testing of a coal or oil for calorific power or for some impurities such as sulphur, which might be detrimental to a certain melting or heating operation if present in excess. The testing and analysis of refractory materials of all kinds such as fire brick, clays, sands, and graphite also come within the scope of his work. The examination of quenching oils, cutting compounds, greases, scraps, and in fact any of the innumerable materials of this nature which enter into the various shop processes may also be a part of the chemist's daily work.

From this outline of the work of the chemist and the metallurgist in one of our large industrial plants engaged in the production of munitions it will be seen that he enters directly or indirectly into some stage or other of almost any of the finished products of the shop.

To sum up, the chemist and the metallurgist have played a prominent part in the development of the munitions industry in Canada and all signs point to the probability that in the future, when the industrial expansion will lie along more peaceful lines, the chemist will be able to still further widen the scope of his many activities.

PHYSICAL TESTING LABORATORY, DOMINION BRIDGE CO.

FROM THE MEN WHO PRODUCE

Methods, Machining Devices, Systems and Suggestions From Shop And Drafting Room

Efficient Appliances for Economic Shell Production

BY J. H. RODGERS
Associate Editor Canadian Machinery

SUCCESSFUL munition production cannot be attained by concentraing on any one particular detail of manufacture but must be dependent upon the co-ordinate combination of every essential factor involved in the entire problem of shell making from the casting of the billet to the crating and shipping of the finished product. However, it will invariably be conceded that efficient equipment and shop facilities are probably the most important requirements for rapid, economic, and successful production. Apart from the well established effectiveness of the single purpise machine, the achievements of shell manufacturers are responsible, very largely, to the special appliances that have been developed for accomplishing certain operations in connection with this industry, and which have generally been designed to meet specific conditions. Varied experience on the part of plant superintendents, and their assistants, not forgetting the mechanics themselves, have been responsible for the many different devices constructed for performing identical operations. In certain instances shop atmosphere has been particularly accountable for the design of home-made equipment, as available material has very often been adapted to a purpose widely different from that for which it was primarily intended.

It is, therefore, not surprising to see the wide range of fixtures now in use in many of the large munition factories, and in almost every instance performing the work with the highest degree of satisfaction.

The following illustrations, with the accompanying descriptions, indicate a few of the large number of accessories that have been instrumental in the successful manufacture of the various shells, and likewise the maintenance of the different tools required for the work.

Determining a Basis for Machining Operations

Rough boring of the fuse hole in the nose of the shell is an operation in which much care is required to assure concentricity with the walls in the main portion of the forging. Owing to the slight variation in dimensions that are unavoidably created during the forging process, it is often very difficult to determine just the exact point from which machining should be based. While the piercing of a hot billet may, to the uninitiated, appear quite a simple operation, the production of uniform forgings is dependent upon so many different conditions that it is virtually impossible to find any two finished forgings exactly identical in every particular. Slight variation in the physical nature of the steel, uneven or irregular heating, presence of scale on the surface of the billet, careless placing in the dies, press out of alignment, etc., are some of the factors that decide the final quality of the product.

Generally, however, sufficient stock is available on all portions of the forgings to assure the production of the finished shell, at least respecting the specified dimensions; physical defects may arise from the same or other causes. The point therefore, is to select some place on the forging that will minimize the machining difficulties contingent on such irregularities. The superintendent of a plant that has had very good success on both the 8 inch and the 6 inch shells, has figured that a position on the profile about midway between the nose and the tangential point of the radius is the portion least subject to the discrepancies of the forging operations.

Invariably, the greatest wear on the forging punch will take place at the extreme nose or at the juncture of the lower taper and the long comparatively paralled section. Consequently, the neutral point will obviously be between these two positions; thus the reason for selecting the aforesaid point as a basis of operations. This method is adopted both for the initial centering and also the subsequent boring of the nose.

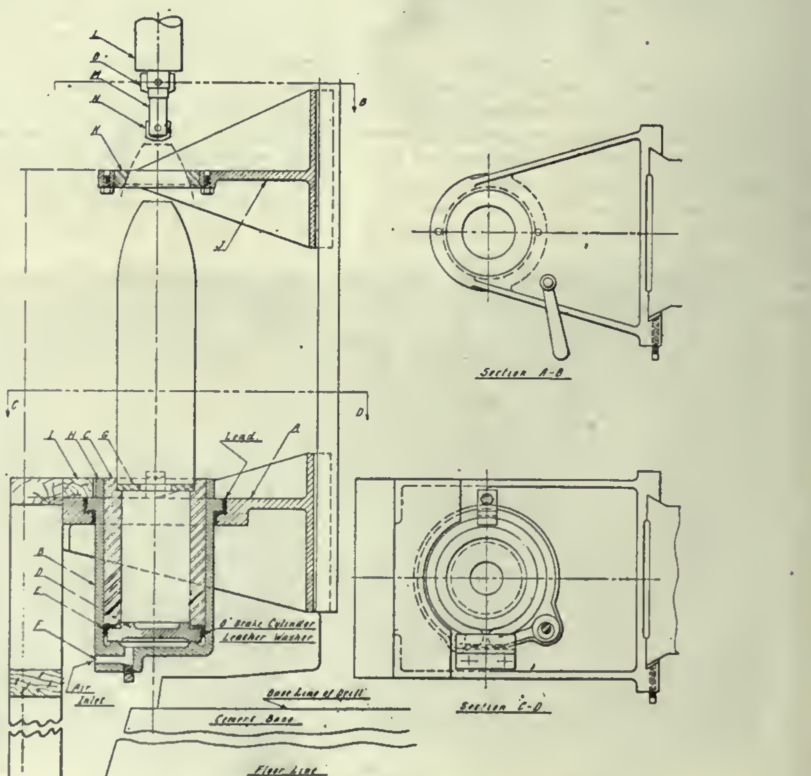


FIG. 1—FIXTURE FOR BORING AND CHAMFERING NOSE.

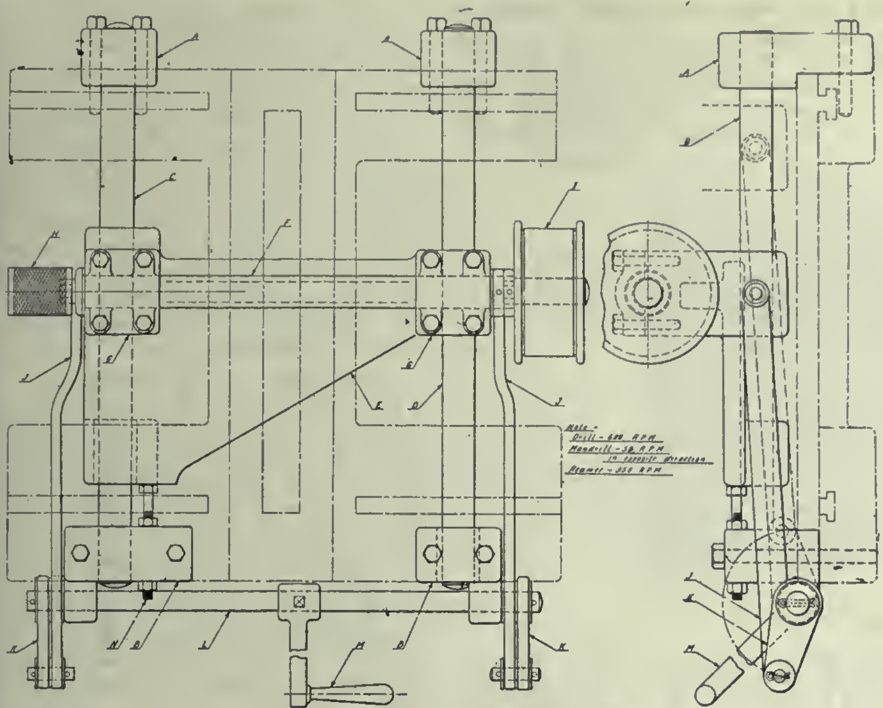


FIG. 2—CENTERING DEVICE.

Boring the Nose for Fuse Hole

In the sketch Fig. 1 is illustrated the device that has been devised for the boring of the nose on the 6 inch shells, after the outer portion has been machined. The attachment is applied to a Baker Drill, the main support for the shell being secured to the vertical slide of the main upright. Fitted to this casting is the cylinder B, in which the tubular plunger C is contained. To the bottom of this piston is fitted the head D and the ordinary air brake cylinder washer E; the inlet for the operating air is shown at F. A thin disc is fitted to the upper end of the plunger to support the base of the shell. Suitable wooden framework is provided on a level with the receiving and discharging runways to facilitate the handling of the shells. When the shell has been elevated to its working position the profile of the nose at the neutral point is forced into the receiving ring K which is held in position in the bracket J by means of the screws shown. For ordinary work, where the hole is comparatively even and not too small, the pressure of the air is sufficient to retain the shell in the proper position, but where excessive pressure is required in the drilling of the nose the shell can be additionally held by the action of a strap clamp H that is located on the upper end of the operating cylinder, and grips the plunger when the same has been forced upward. The roughing and the facing cutters are shown in position above the shell.

Importance of Initial Centering

A detail that is of vital importance in the ultimate success of the finished product, and one that has been often emphasized as an essential feature in connection with efficient production, is the initial centering of the shells prior to any of the following machining operations. Too much attention cannot be given to this simple but apparently insignificant detail. Upon the accuracy of the primary centering of the nose or the base, as the case may be, depends the final success or failure of the shell making process. Owing to the boring of the shell being the most difficult in the many operatios on the shell it is the recognized practice to work from the rough bore when a start is made on the gauging and drilling of the center from which the outer portion is to be turned. Common practice is to use expanding arbors for holding the forging while this centering is being performed. Generally the method adopted is to grip the inner walls on the parallel portion of the bore, but as stated above the better method is to select a neutral point on the inner profile where the irregularities are less likly to appear, or if so they are less pronounced. The chief feature in connection with centering devices is to have the mass rigid and as accurate as conditions will permit, and also to so design them that their operation will be as rapid as possible consistent with satisfactory work.

Special Centering Device

The devices that have been constructed for the efficient performance of this operation have been quite numerous and few plants have adopted the exact method for accomplishing the work, and it would probably be difficult to pick out any particular one that was more efficient than any of the others, each having their own pecularities and advantages. The one here illustrated has given very good satisfaction in the shop in which it is now used. The attachment is fitted to an ordinary engine lathe the spindle of which is equipped with a suitable extending arbor holding and revolving the shell. On the top of the traverse carriage is fitted the brackets A. A. and B. B., these brackets supporting the two cross slides C and D, which are lined in position by the pouring of babbit in one or other of the brackets when the complete fixture is in proper alignment. The main bearing casting E that carries the centering spindle F is fitted with three bearings to maintain alignment of the spindle. This is kept revolving continually and the center drill and the countersink are used alternately by changing in the small cam operated chuck H. The connecting rods J are attached to the lower portion of the cross slide and also to the operating shaft L by means of the short link K. By the movement of the handle M this toggle arrangement provides a rapid means for displacing the drill spindle out of a working position for the convenient placing and removing of the shell from the arbor. The positive stop N assures the exact alignment of the spindle when the same is returned to a working position. By running the arbor in the opposite direction to that of the drill spindle additional assurance is given to greater accuracy. In this case the work revolves at 50 R. P. M., the small drill at 600 R. P. M, and the reamer or countersink at 350 R. P. M.

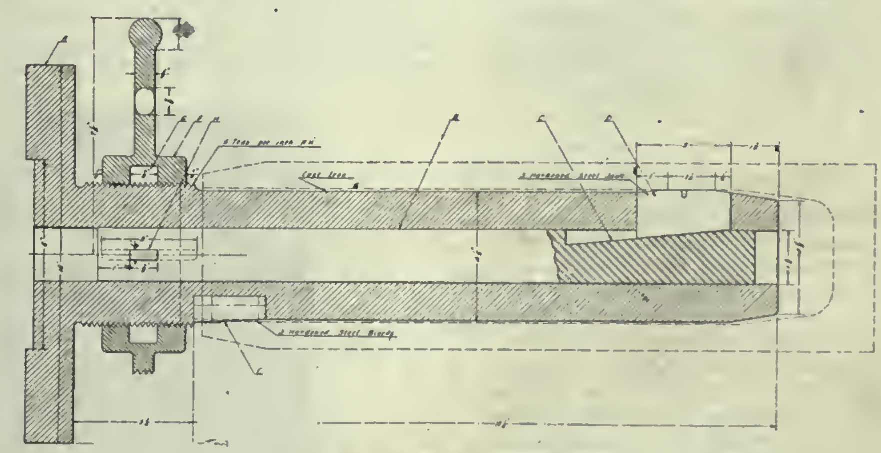


FIG. 3. RECENTERING ARBOR.

Centering Arbor

An arbor for recentering the shells after the boring has been completed is shown in Fig. 3. In this case the shell is centered at two points, at the open end and also at the section just adjoining the inner profile. The main portion of the arbor A, which is made of cast iron, is equipped with a large flange at the back end for bolting to the face plate of the lathe. Contained in the 1¾ inch hole through the center of this piece is the operating bar B, which has three equidistant tapered slots shaped in as shown at C, these being placed at an angle approximating 6 degrees. The gripping jaws D operated through slots cut in the outer end of the main arbor. These are collapsed by the action of the ordinary ring spring shown. For the centering of the open end the three hardened blocks E are fitted into the body of the arbor A. The handle for controlling the operation of the jaws is threaded to the rear end of the arbor, the position of the jaws being determined by the location of the said handle. The recess G in the handle is a close fit for the cross bar H which is a driving fit in the central operating rod. For screw operated arbors it is much better to have the control handle within easy reach of the operator, particularly where the actual machine work takes but a small portion of the total time.

Collet Chuck for 6-Inch Shells

Debate has often arisen as to whether the use of air operated chucking devices have any particular advantages over the hand operated type. When all things are considered, apart from the possible increase in the rapidity of operation, it is doubtful if the adoption of the air has any outstanding advantages over appliances operated by the hand method. The upkeep in both cases is often considerable but the initial outlay in respect to a complete installation of air generating equipment is frequently a subject not generally favored, by the small manufacturers in particular. An objectional feature that is often evident in the operation of screw chucks is the use of a sledge to free the jaws from the work after the handle has been released. To overcome this trouble one plant devised the simple attachment illustrated in the sketch Fig. 4. In many respects this chuck has similar features to those of other makes but the interesting point in connection with this particular one is the arrangement of the control at the rear of the lathe spindle.

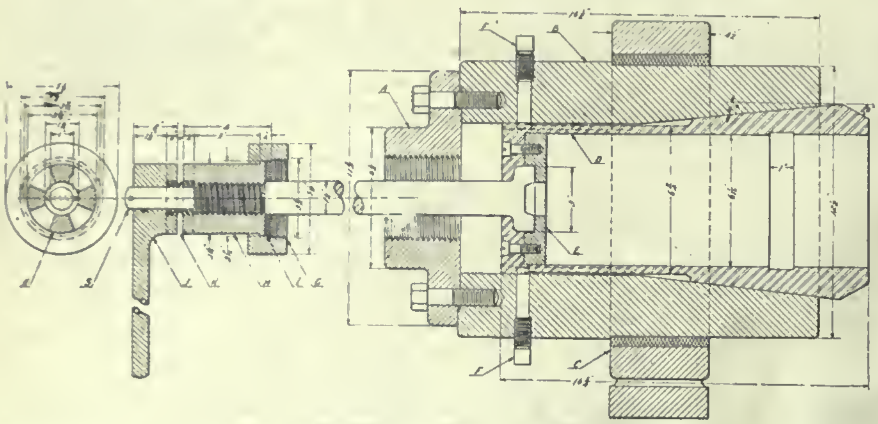


FIG. 4. ASSEMBLY OF COLLET CHUCK.

To the face plate A of the lathe is secured the main cylindrical portion of the collet chuck, the outer diameter running in the steady rest C for added rigidity. The split collet is provided with exceptionally long bearing on a taper of about 6 degrees with the axis of the lathe spindle. The inner end of the draw rod is fitted with a head that is located in a pocket formed by the tail of the collet and a special ring E, the latter having an opening in the center to allow the tit on the base of the shell to enter undisturbed. The screws F are fitted with hardened points which enter corresponding slots in the collet to prevent the same from turning under the action of the screw. Fitted to the rear end of the spindle is the collar G, which in turn supports the flanged bush H, a retaining bronze washer I being located between it and the end of the lathe spindle. The handle J, which rides free on the shaft S when the lathe is in operation, is fitted with a clutch face K, corresponding to that on the back end of the bush H, which is threaded to the draw rod S as indicated. To tighten or release the chuck the clutch K is used, and the action being positive in either direction, prevents the seizing of the collet jaws on the surface of the shell.

Expanding Driver

A simple expanding driver is shown in Fig. 4a. The steel container A is fitted to the spindle of the lathe, a recess being provided to take the inner end of the draw rod B, this recess adding to the rigidity and ease with which the screw may be operated. The hardened steel plug D is provided with three slots having a taper of 3 degrees with the axial line of the lathe spindle. The jaws E are the ordinary hardened type and may be serrated as shown for roughing operations.

Importance of Smooth Bores

Apart from the actual operation in connection with the machining of the shells, the upkeep of the tools is a detail that requires considerable attention to enable the work of munition making to be accomplished with maximum speed and economy. Successful production is dependent as much on efficient methods of tool maintenance as effective methods of machining operations. This is not only true in respect to some of the more important essentials but likewise to many incidental details that are very often put down as of minor significance. Probably few details are more important as having a vital bearing on successful shell production as the resultant work of boring cutters. In this particular it might be safe to say that more trouble has been occasioned than in all the others combined.

The importance of smooth bores entirely free from any irregularity of any kind has been emphasized ever since the inception of the shellmaking activity. The action of the shell in flight is such that dangerous consequences may result from even the slightest roughness or irregularity in the bore of the shell. To make this more clear, it must be understood that the charge contained in the high explosive shell is very susceptible to the action of the friction, so that the slightest scratch may form the basis of a premature explosion, an occurrence that must be guarded against by every means in the power of those responsible for the safekeeping of the men at the guns. The rifling action of the bore of the cannon has an instantaneous effect on the shell proper, and this revolving action cannot very well be immediately

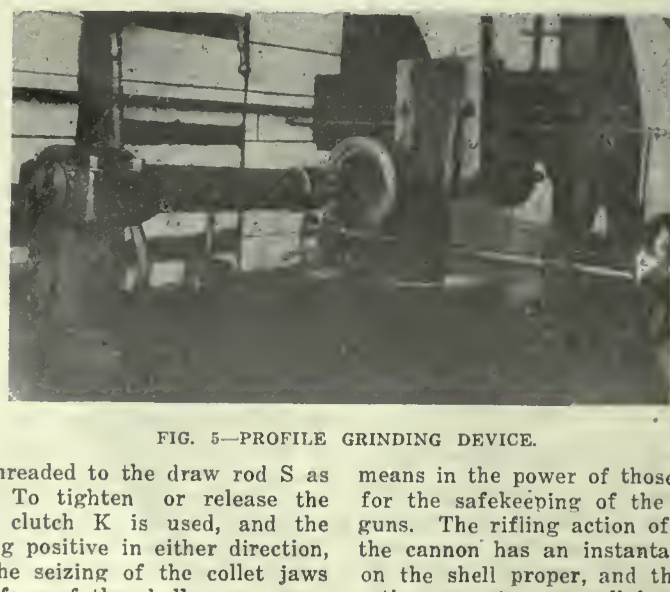


FIG. 5—PROFILE GRINDING DEVICE.

transferred to the inner explosive charge. The sudden centrifugal motion set up in the shell itself, when discharged, causes a relatively opposite motion on the inner charge; that is, the direction of motion of the shell and the charge are both the same but the speed of the former is much the greater, and until their motion becomes uniform, the possibility of premature explosion is ever present. For this reason it is imperative that every caution be taken to guard against such an eventuality, thus the care that is exercised in attaining a bore that will minimize, if not eliminate, the danger contingent to imperfect shells.

The smooth bore of the shell has been a feature in connection with shell production that has been given very much attention, but absolute perfection is next to impossible, as it may not be generally known that an exceptionally smooth bore may develop what appears to be physical defects that inexperienced inspectors may have difficulty in passing. This however, is a factor that might very well be overcome with a little instruction or enlightenment on the part of the inspectors. The essential consideration under known conditions is to produce a bore that will be as free from imperfections as present practice is capable of accomplishing.

Maintenance of Boring Cutters.

The maintenance and the accuracy of boring cutters are the prime factors in the production of work that will meet the strict requirements of shell specification. The numerous designs of boring bars and cutters that have been developed for this particular operation, together with many appliances constructed for the maintenance of the same, has clearly shown the efforts that have been made to overcome the difficulties incidental to maximum efficiency. The accuracy of the boring cutters, both as regards the shape and the dimensions, has invariably been left to the judgment and experience of the tool makers reserved for this purpose, the mechanical grinding of such tool to the proper contour not having been given much attention, owing to the difficulty of devising appliances to handle the work. Recently however, certain plants have constructed fixtures and other devices that have practically eliminated the possibility of inaccuracy resulting from the inability of the workmen to adapt themselves to this important detail. Such devices have not only aided in producing better work at less cost but have virtually removed the human element in the errors that might arise from faulty ground cutters.

FIG. 7—FACE GRINDING ATTACHMENT.

Interesting Grinding Fixture

One of these mechanical and almost automatic grinding fixturls is shown in Fig. 5. This cut shows the device as developed by the Montreal Tramways Co. for grinding the boring cutters for the 6-inch Mark XI. shell. The sketch Fig. 6 will illustrate more clearly the construction of the device. It was decided to utilize an old planer for the groundwork of this apparatus, owing to the unique advantages such a machine had for the operation and application of the parts. The main casting A, for supporting the boring arbor, is pivoted at the point B, by a pin which is secured to the table of the planer. The arbor D is held in position by the cap C, and is inclined at an angle with the axis of the grinding spindle, of about 6 degrees. The object of this is to alter the clearance on the cutting edge of the cutters. The inclination is such that with the tip of the bar in the circular direction, gives a variation of from about 7 degrees clearance at the nose of the cutter to a nil clearance at the extreme base of the cutter. This not only provides an ideal cutting angle for that portion of the cutter at which the bulk of the work is performed but also furnishes a non-cutting support and guide for that section of the cutter that has often, under other conditions, given no end of trouble. One of the difficulties that has frequently been experienced in the boring of the various shells has been the tendency of the cutter to gouge out a recess at the base of the shell, which could seldom be detected by the naked eye, but was quite evident under the examination of the inspectors with suitable instruments for the detection of such imperfections, the result being that many shells were rejected for this reason.

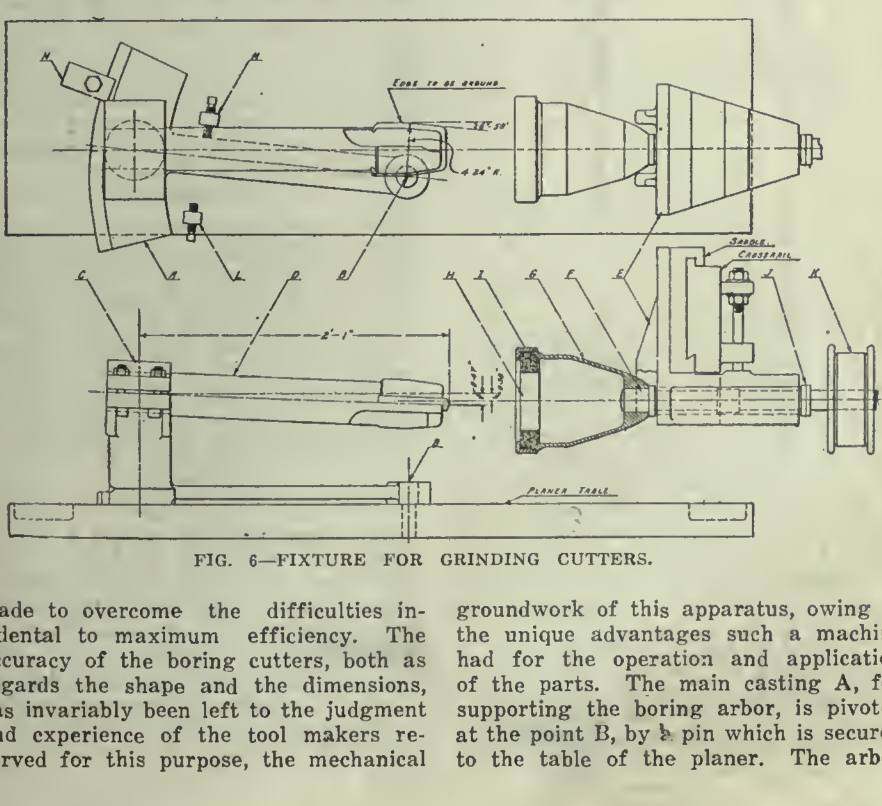


FIG. 6—FIXTURE FOR GRINDING CUTTERS.

Secured to the cross rail of the planer is a special casting that carries the grinding spindle F, to the nose of which is secured the wheel chuck G. It might be stated that this impromptu pot chuck is made from the upper portion of a spoiled shell, the walls having been lightened to facilitate the operation. The grinding wheel H is held in position by the large nut I. These wheels are made specially for this purpose, the diameter of the hole being such as to give the best results. Adjusting nuts J are provided on the rear of the grinding spindle to take up any lost motion in the shaft. Stops are located on the planer table to regulate the position of the bar when grinding the parallel and also the tapered portion. When grinding the straight sections the fixture is firmly clamped by means of the clamp N. The position of the pin B is so arranged that when the bar is being moved from one fixed position to the other the radius between the parallel and the tapered section, is automatically formed. After these cutters have been ground in this manner the only requirement is a slight application of the oil stone to remove any small burrs that have been formed. The longitudinal feeding arrangement is shown in the half tone cut Fig. 5.

Grinding Nose of Cutter

A somewhat similar device has been developed in the same shop for grinding the face and end radius of these same cutters. This is illustrated in Fig. 7, and a line drawing of the device is shown in Fig. 8. The foundation for this apparatus is a long piece of channel iron, upon which is secured an ordinary compound rest B, the upper portion C supporting the small angle iron D, to which in turn is bolted the small slide E that carries the electric grinder F. Lateral feed to the grinder is obtained by means of the small handle G. Also secured to the channel iron is the disc casting I, the central pin of which is located directly below the center of the nose radius of the cutter when the same is in a grinding position. Pivoted on the pin I, is the casting J, which, by the way, is a discarded trolley base; to this casting is secured the bracket K for retaining the bar M in position, an additional support being provided at N, in the shape of an adjustable Y support. A dust cap is provided to protect the bearing I from the dust of the wheel. As shown by the small end sketch, the bar is tipped in two directions so that when the fixture is swung around to grind the radius the clearance will correspond with that obtained on the preceding operation. Stops that are shown in Fig. 7 are provided to determine the exact position for either cutter.

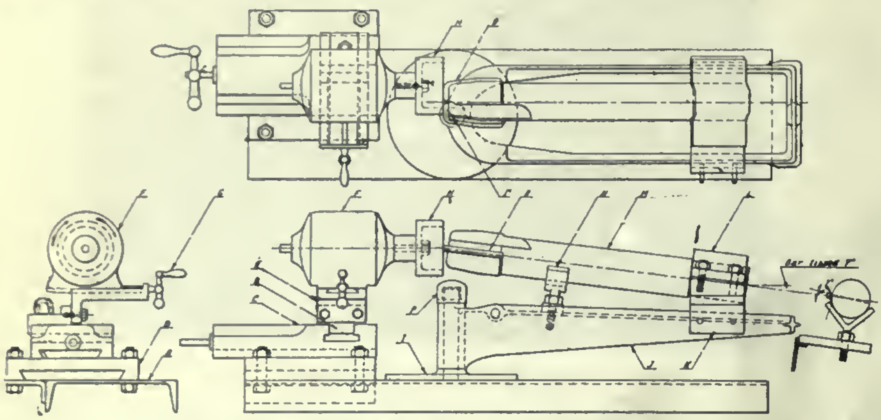


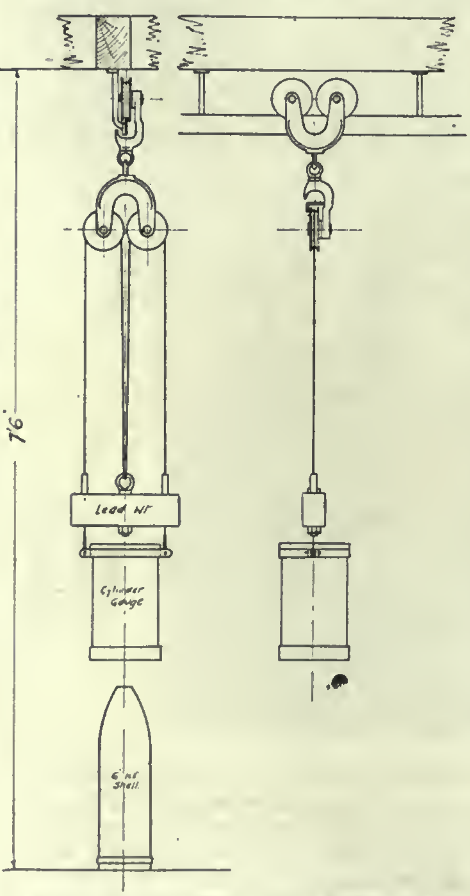
FIG. 8. GRINDING ENDS OF BORING CUTTERS.

AN EFFECTIVE METHOD OF USING THE CYLINDER GAUGE ON 6-IN. H. E. SHELLS

By J. S. Downie

The cylinder gauge which is used for gauging concentricity of driving band with body of shell is often a very awkward one to use. It is heavy, weighing about 45 lbs., and if the band on the shell happens to be "high" in diameter or slightly eccentric, the gauge gets jambed down over the band and is often the occasion of considerable vexation and profanity before it is again got free. Unless properly suspended and balanced this gauge is apt to be the bugbear of any examination room and the "willing horse" generally gets the job of using it.

The method of using this gauge varies in different plants but it is usual to balance it in some way by means of a balance weight working through an overhead pulley. In small shops the gauge is generally suspended near to the weighing scales and each shell is gauged as it comes off the scales. This method is objectionable as it causes violent vibration in the vicinity of the scales and tends to make weighing inaccurate. It also necessitates the standing up of the shell immediately after coming off the scales which is a needless time and muscle absorbing operation. The most efficient method of using this gauge is by means of an overhead runway suspended immediately above where a line up of shells is to be examined on the bench.



METHOD OF HANDLING CYLINDER GAUGE.

The writer found the equipment shown on the accompany sketch answer the purpose admirably. The runway is formed of a special 'I' section of steel 2½ x ⅜ and can be bought in lengths suitable for any length of room and with the requisite fittings and equipment. The cylinder gauge is so arranged that it will hang from the runway and be free to run along a whole line-up of shells for the entire length of the room. The proper suspension of the balance weight is essential. A weight which is not properly hung or is not of the right form will frequently cause considerable bodily injury to the fingers or head of an unwary examiner.

The balance weight is of lead and is securely guided and held in place by the suspension wire rope and cannot injure the examiner or the surface of the gauge. The double runner which is a standard fitting, acts as a double sheave when inverted and linked together as shown. It also allows of the gauge being swivelled to any angle. This equipment has been found to answer all the purposes for which it was intended very satisfactorily.

Enlarging Business

The Cincinnati Iron and Steel Co. have changed their organization and are now known as the Cisco Machine Tool Co. The company have just lately erected a new building which gives them machine working space of two floors 64 x 230, this being exclusive of offices, warerooms, show rooms, shipping rooms and storage rooms which are in separate buildings. This building is equipped with all modern facilities, cranes, runways and every possible contrivance for the comfort of the workmen, while they have also installed considerable new machinery, including a 62 x 48 x 28 planer, a 3½ boring mill, 4-foot radial drill, two new milling machines, new keyseaters, arbor presses, upright drills and lathes, so as to increase production. The idea will be to double the number of men that are employed, and to keep up to its present quality the Cisco lathe.

ACID in oil will cause corrosion when in contact with moisture. The presence of sulphuric acid may be determined by a solution of barium chloride in distilled water, a few drops of which put into the oil after it has been thinned with an equal amount of gasoline or benzine will cause a whitish precipitate if acid is present. In the absence of moisture the acid is not so active and may escape notice.

A NEW polishing composition has been patented made of 8 oz. ceresin, 2 oz. beeswax, 2 oz. parafin, 6 oz. linseed oil, 28 oz. spirits of turpentine and 1 dram of carbolic acid. The first three ingredients are first mixed together and heated to the liquid form; the mixture is poured into the turpentine, the remaining constituents added, and the whole stirred until slightly cold.

The New Shell Has Brought Out New Methods in the Canadian Plants

Machining the 75-mm. in Modern Shop

BY A. G. WEBSTER
Associate Editor Canadian Machinery

THE 75 mm. shell being manufactured at the plant covered in this article is of the high explosive type, and a number of interesting methods have been devised for their production, some operations of course differing from those used for other types of shell.

The 75 mm. forgings, which are made in Canada have a minimum length of 11.825 in., a maximum diameter of 3.3 in., and weigh 22 lbs. The forging is very similar to the shrapnel, having the nose end open, but at the base there is a tit or boss. The shells have to be heat treated and the nose closed in as in the shrapnel shell. All forgings have a heat number stamped on the base and forgings bearing the same heat number are kept in a separate group. Each group is put through the various operations as a unit and a certain percentage is taken from each group for testing purposes. Each group is held until the results of the test have been made known when the remainder of the operations are proceeded with.

Cutting Off Open End

The first machining operation is cutting off the open end on cutting-off machines built by John Hall & Sons, Brantford, Ont. The shell is held in a universal chuck, the point to start the cut being determined by putting a gauge inside the bore, the outer end of gauge returning over the shell and the front cutting-off tool being placed in line with the end of gauge. There are two tools, front and back, mounted on the carriage, both feeding in and cutting simultaneously. When the end has been cut a beveled reamer at the end of a bar is inserted in the bore to remove burrs from the inside edge of hole. The cutting-off is only a roughing operation, the extra metal being removed when the nose is being machined after closing in.

Centering Base

After the open end has been cut off a center is drilled and countersunk in the tit on the base. In this operation the shell is held on an expanding mandrel while the combination drill and countersink is attached to a fixture on the bed of machine. The drill is fed forward by means of a hand lever. The buttons on the mandrel are drawn in before the shell is placed on it by means of a system of rods and levers operated by a foot lever. When the shell is placed on the mandrel the foot lever is released and the buttons forced outwards by springs, grip the bore of the shell. The rod operating the buttons on the mandrel passes through the head of the machine and is connected by rods and levers to the foot lever.

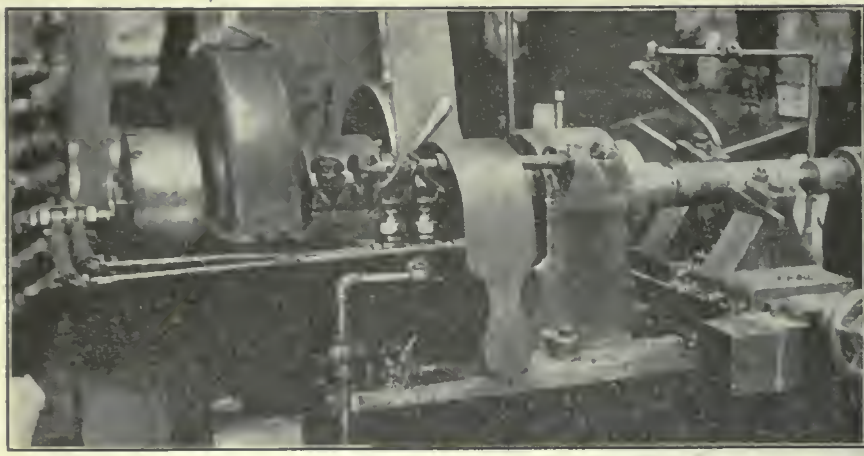
Rough Turning Body

The third operation consists of rough turning the body on a Bertram lathe equipped with an air chuck operating a short expanding mandrel for holding the open end of the shell while the base is supported by the tail center. The mandrel has two serrated buttons which are forced out by the action of the air chuck and grip the bore of the shell.

Two tool rests, back and front are mounted on the cross slide, the front tool makes the first and heavier cut, beginning at the base end, which is immediately followed by the back tool making a lighter cut. Both tools used are Stellite, and the cutting speed is 67 ft. per min.

Inside Boring

The next and fourth operation is rough and finish boring the inside of shell on a Bertram turret lathe. The lathe is equipped with a Manufacturer's Equipment Co.'s air chuck and a Bertram collet chuck for holding the shell. There are three tools held in the turret which are employed in the following sequence. The first tool is a bar with a forming cutter at the end for roughing the base inside. The second tool is a boring bar for roughing the inside contour of shell. This bar has also small cutter at its base for rough facing up the nose. The third boring bar has a similar cutter for finishing the contour and also a forming cutter for finishing the base inside. This bar has also a small cutter at its base for finishing the face of nose. The finishing cut is made at a slower speed than the first two. All three bars have a small hole drilled the entire length to convey the cutting lu-



ROUGH AND FINISH BORING OPERATIONS.

bricant to the tip to wash away the chips as well as lubricate the cutter. A flexible tube is attached to the base of each boring bar, connecting it with the lubricant supply tank.

Grinding Bore

A minor operation is performed at this stage to clean up the base inside. This is a grinding or buffing operation. The machine has a horizontal spindle at the end of which is a grinding wheel of special shape. While the spindle is being revolved the shell is held up to the wheel and the base inside finished.

Cut Off Base

The next operation is cutting off the base on John Hall & Sons cutting-off machines equipped with air and collet chucks. There is a bar stop inside the head to locate the shell in the correct position. The machine has two tools, back and front, both cutting simultaneausly. This operation removes the tit which has carried the countersunk centre.

Re-Turning Outside Body

The seventh operation consists of returning the outside of shell to make the outside concentric with the bore of shell. This operation is performed on C.M.C. lathe equipped with a Manufacturers' Equipment Co.'s air chuck and an expanding mandrel. The mandrel has four serrated buttons for gripping the bore of shell. The machine has two tools, back and front, which take one light cut the entire length of the shell and then another cut from the base up, for about 2 inches.

Finish Base Thickness

The next operation, the eighth, is to bring the base to the required thickness. Before the shell is put on the lathe it is gauged to ascertain how much metal has to be removed to bring the base to the required thickness. The gauge used for this purpose consists of two parallel rods connected at one end by a swinging arm. One rod is put in the shell until it bottoms and the other has two feet which rest on the shell body while at the end it has a centre punch for marking where the shell has to be cut off at the base.

A C. M. C. lathe equipped with an air chuck and Bertram collet chuck is used for facing the base. There is a stop in the collet chuck to locate the shell in the correct position. Usually a light cut is all that is necessary to make the base the required thickness. The shell is then gauged again to see if the proper amount of metal has been cut off. The base is left on the "high" side after being machined. At this stage the shells are carefully gauged and the bore examined by inspectors to catch any imperfections before the shells are taken to the heat-treating department where the nose is closed in and the shells heat treated. This is the first government inspection.

Closing In Nose

This heat-treating department contains a furnace and press for the nose operation and two continuous furnaces for the heat treatment. The furnace for the nosing operations will heat nine shells at a time. It is fired with oil fuel. The press is a rebuilt Bertram power-driven punching machine with the dies bolted to a plate attached to the ram. The seat for the shell base is fixed to the table which is stationary. The seat is so designed that the shell can be slid into it; thus requiring less head room when lifting the shell in and out. The press is located quite near the furnace so that the operator can take the shell from the furnace and place it in the press at one motion. The ram is released by a foot lever when the shell is in position.

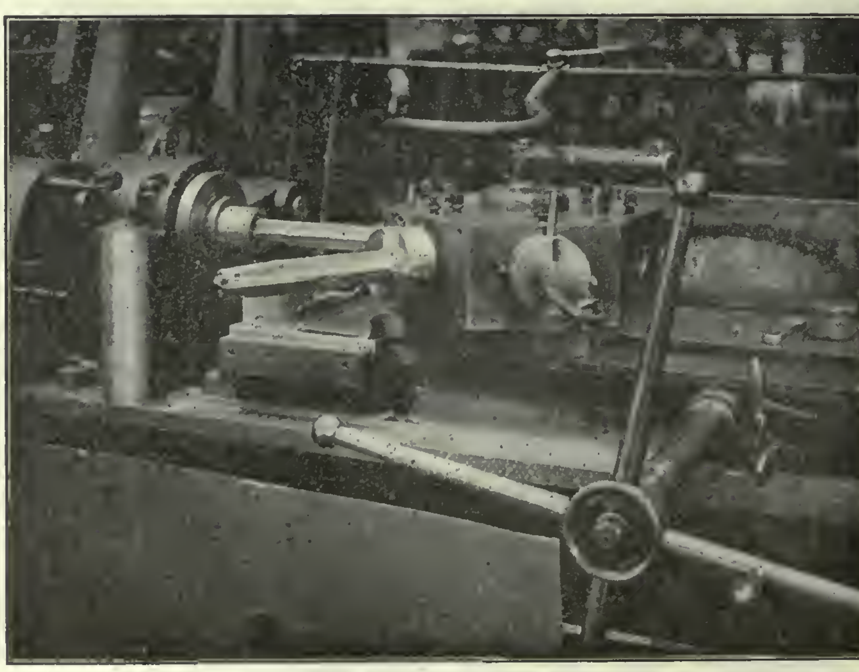
Heat Treatment

The hardening and tempering furnaces are both of the continuous type and are the same design and size. This type of furnace has two oil burners at each end, one at each side near the bottom. The hearth of the furnace is inclined so that the shells when fed in at the back can roll down gradually towards the front end. The rolling motion is assisted by a pusher at the back which is located just outside the furnace and at the point where the shells are fed into the furnace. The pusher has a reciprocating motion and is operated by a pulley through a belt from the line shaft. Two rows of shells are fed through the furnace giving a production of about one thousand in a twelve-hour shift.

The hardening furnace is maintained at a temperature of 1,550 degrees Fahr., and it takes each shell about 38 minutes to pass through. After being heated the shells are quenched in an oil bath and then passed on to the tempering furnace. The oil is cooled by pumping it to a tank outside and then back again to the quenching tank. The temperature in the tempering furnace is around 1,100 to 1,150 degrees Fahr. and the time occupied is the same, viz., 38 minutes. The shells are cooled off gradually after being in the tempering furnace. Hoskins thermo-electric pyrometers are installed for controlling the temperature in these two furnaces and also indicating and recording instruments.

Brinell and Tensile Tests

At this stage of manufacture it is necessary to prove that the shells possess



ROUGH TURNING, OUTSIDE BODY.

FURNACE AND PRESS FOR CLOSING IN OPEN END AND FORMING NOSE.

the required degree of hardness. It is essential that the physical properties of the shell should be within certain well defined limits which are obtained by the heat treatment. There is a Brinell test, which corresponds to the schleroscope test, and also a tensile test. There is also a hydraulic test which will be referred to later.

For the Brinell test, ten per cent. of the shells are tested, which is equivalent to 50 out of each group of 500. In this method each shell to be tested is placed on an Olsen testing machine. A flat spot is first ground on the shell body when it is placed on a V block which is so adjusted that the pressure will always come in a radial line with the axis of the shell. A hard steel ball is then pressed into the shell making an indentation 10 mm. across under a pressure of 6,600 lbs. The readings which are taken through a microscope should give between 3.9 and 4.5 mm. The pressure is applied for 15 seconds, but as slight variation in the dimensions of the indent may arise from unequal length of time of applied pressure, it is desirable to check the period of time accurately.

For the tensile test, one out of every thousand shells is selected and two test pieces cut out on a milling machine. The test pieces are machined to the required shape and sent to a government laboratory for the tensile test, each group of shells is held up until the result of the test is known.

Boring Nose and Recess

After the shells have been heat treated and tests have proven satisfactory they are taken over to have the nose finished off. This is done on a number of turret lathes built by the Davis Machine Tool Co, Rochester, N.Y. All these machines have air and collet chuck equipments for holding the shell. The turret holds five tools, the first consisting of a stop which bottoms in the bore and a double end cutter for facing up the nose end. The second tool rough bores the nose and recess. A reamer is then passed through the nose, finishing the part that will be threaded, while the fourth tool finishes the recess behind. The fifth tool faces off the end of nose to length.

Threading Nose

The nose-threading operation is done on a Bertram turret lathe, the turret being equipped with two Murchey collapsible taps. The lathes have air and collet chuck equipment. Two collapsible taps are used for this work, it has been found that better results were obtained than by using one tap only. The strain on the taps is diminished and more accurate threads are formed.

Finish Turning Body

A number of C. M. C. lathes are used for this operation which consists of finish turning the nose profile and body as far as the copper band. These lathes are also equipped with air chucks and collet chucks for holding the base of shell. The screwed centre which has been inserted in the nose is carried on the tail centre.

Th forming cam which is situated under the work has a spring for holding the roller on the cross slide up to the cam, thus forming the correct profile. A light cut only is taken at this operation.

Grinding the Bourrelet

A special operation is necessary for finishing the bourrelet as there are practically no limits to the size, and it also must be very smooth. The bourrelet is finished on a Ford-Smith grinding machine, equipped with air and collet chucks. The screwed centre is retained in the nose and carried on the tail centre.

Facing Base

Two or three short operations now follow. The first is facing the base and the second is finishing that part of the body near the base not machined when the body was finished. Both operations are performed on C. M. C. lathes equipped with air and collet chucks, and a light cut is taken with an ordinary turning tool.

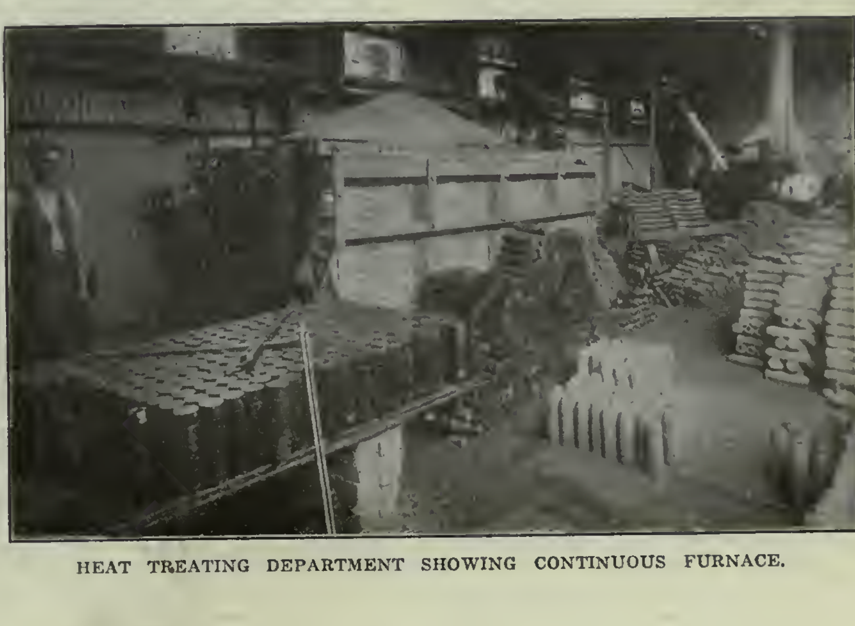
Copper Band Recess

The recess for the copper band for the 75 mm. shells differs from the shrapnel in that it is knurled instead of having waved ribs. The purpose, of course, is the same, to prevent the copper band from moving round. The machine for this work has the standard air and collet chucks.

The tools are mounted on the cross slide, back and front, with a drop down stop between them. The stop is for the purpose of adjusting the shell in the correct position. The front cutter which forms the groove is used, first by being fed up to the work, when the groove has been formed the back tool is brought into play and a straight rib formed.

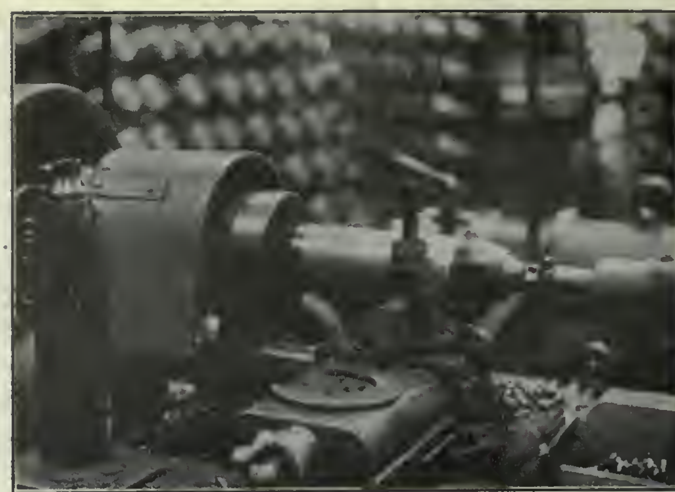
Knurling

The shells are then taken over to a machine nearby to be knurled. The knurling machine consists of a cradle with four smooth rollers for carrying the shell in a horizontal position. A lever forces the cradle, and with it the shell,



HEAT TREATING DEPARTMENT SHOWING CONTINUOUS FURNACE.

FINAL INSPECTION.



FINISH TURN, BODY AND PROFILE.

up, bringing the groove in contact with the knurl. The knurl is fixed on a horizontal spindle and is driven by a pulley from the line shaft. While the knurl revolves, the groove is pressed up against it, thus forming the knurl in the groove.

Chamfering

The end of the shell body at the base is chamfered to take the cartridge case and a chamfer is also formed near the copper band groove, on the base side. The angle of chamfer in the first case is 9 degrees and in the second 4 degrees.

The machine is equipped in a similar manner to that used for forming the groove as described above, except that the tooling is slightly different. One tool holder is mounted on the cross slide with two chamfering tools. Between them is a roller which engages with the shell body and allows the cutters to work concentrically.

Base Cover Groove

The 75 mm. shell has a brass base cover to protect it from the corrosive action of the explosive. A circular groove is formed in the base in which this cover is secured. A Bertram lathe with air and collet chuck equipment is used for this operation.

The tooling arrangement which was designed specially for the work consists of a fixture containing two tools. The first tool roughs the groove and is fed up to a stop. The second tool which is operated by a lever and has been moved away from the work is then fed forwards towards the shell base and forms the undercut. This tool slides forward at an angle to form the undercut.

Hydraulic Test

The next operation is the internal hydraulic test done in a Metalwood hydraulic testing machine. There are two of these machines each having a capacity ranging from 1.200 to 1,500 shells per day. The shell is first filled with water, or sealed, in the tank and placed nose down in the press. A pressure of 10,000 lbs. per sq. inch is applied inside the shell. This test is made in order to detect by excessive expansion any defects such as leakage or defective and porous material, as well as heat cracks, resulting from improper heat treatment. The permanent expansion of any shell over .003 will cause rejection. The pressure is applied for 15 seconds and the expansion readings are taken at a point about ½ in. below the bourrelet.

The extension of the shell body is measured while the pressure is being applied. The measuring device consists of a clamp which grips the shell body and also carries an indicator. When the shell expands outwards under pressure the indicator shows the amount of extension. Ten per cent. of each group of shells are subjected to this test.

Cleaning and Sand Blast

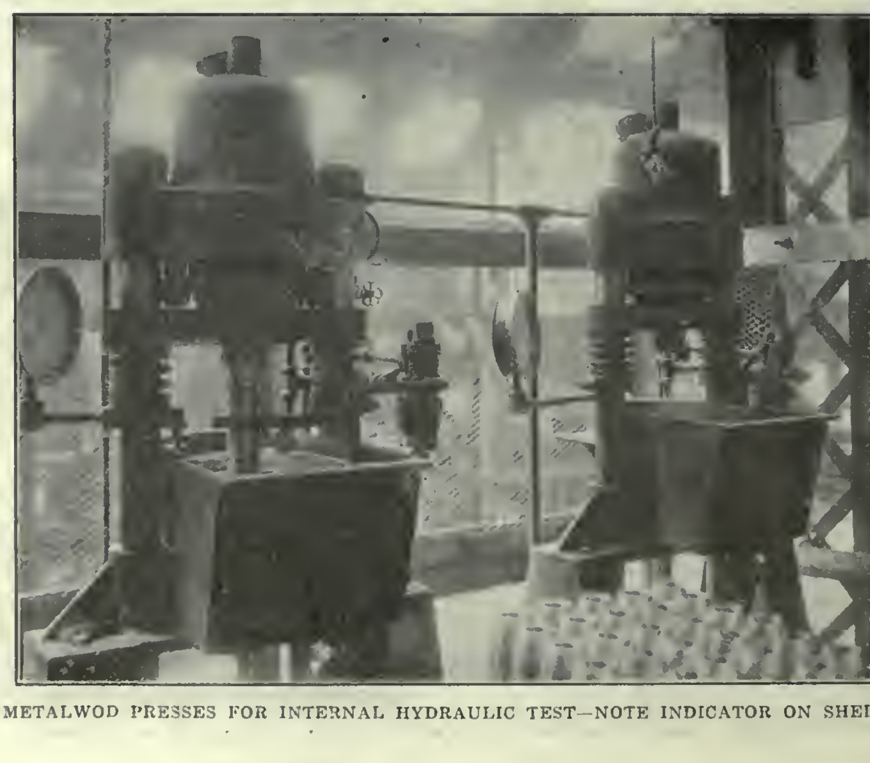
A series of less important operations now follow, the first being sizing the nose threads which is done with hand taps. The shells are then washed in hot soda water to remove grease and dirt, etc., and then taken to the sand or shot blast. This operation, which removes tool marks and scale from the shell is done on two machines supplied by the Gray Mfg. Co., Toronto. The shell is held nose down in a fixture which is revolved slowly, while shot drawn into the air line is injected into the shell bore.

Nicking the nose is the next operation, being performed on a bench miller. The shell is clamped in a horizontal position on a fixture on the table of the machine, then a small slot or nick is milled in the nose. The shells at this stage are carefully examined, gauged and weighed, etc. This is the second government inspection.

Copper Band Operations

The shells are now ready for the copper band. The band is pressed into the groove, cold, on an hydraulic wheelpress rebuilt for this particular service.

The copper band is turned on a Symington machine equipped with air and collet chucks. A stop in centre of chuck fixes the correct position of the shell. The shell nose is carried on a



METALWOD PRESSES FOR INTERNAL HYDRAULIC TEST—NOTE INDICATOR ON SHELL.

TRUCKS USED FOR CONVEYING SHELLS BETWEEN THE VARIOUS OPERATIONS.

cup centre on tailstock centre.

The forming tool is at the back on the cross slide, while at the front is a tool rest used for hand turning when trimming the band.

Pressing Base Cover

At this operation the base is finished. A lead disc with the brass cover is laid on the base of shell and the cover rolled into the groove, machined out at an earlier operation. The base cover is pressed on in a drill, the spindle being equipped with a special device containing three hard steel balls. The shell is held in a box vise on the drill table while the base cover is being rolled. The rolling expands the brass cover, forcing it into the groove. The middle of the cover is pressed down against the base during the operation by a spring stop in centre of rolling fixture.

The flat lead disc is 2.2 in. diameter and .03 in., thick. The brass base cover which is slightly cupped, is 2.56 in. dia., and .02 in. thick.

The body of the shell is now marked with the firm's initials and the lot number. The machine used for this operation is a Bertram marking machine.

Shot Blast and Wash

The shells are again cleaned in a Gray shot blast machine, the same type as described in a previous operation. The shells are then washed in hot solution of borax and water and rinsed with cold water by means of a bubbler. The shells are afterwards laid on a bench and dried with compressed air.

Varnish and Lacquer

The shells are coated inside with a thin layer of shellac varnish to protect the steel from the corrosive action of the explosive. The shell is varnished while rotating on belt-driven rollers let into the table. The varnish is sprayed in by an Eclipse air-brush after which the varnish is air dried. A brass bushing is placed over the threads in the nose before the varnish is sprayed in.

A coat of blue lacquer is applied to the shells, lacquer being used instead of paint. This operation is done on a Canadian Fairbanks-Morse painting machine which enables six shells to be lacquered at a time. The machine has six stands for the shells, the stands being rotated slowly by an endless chain drive. A wheel upon which the stands are mounted is rotated by hand. The wheel is mounted on ball bearings and requires very little effort to turn it round as each shell is finished. The varnish and lacquer were supplied by Lowe Bros., Toronto.

Final Operations

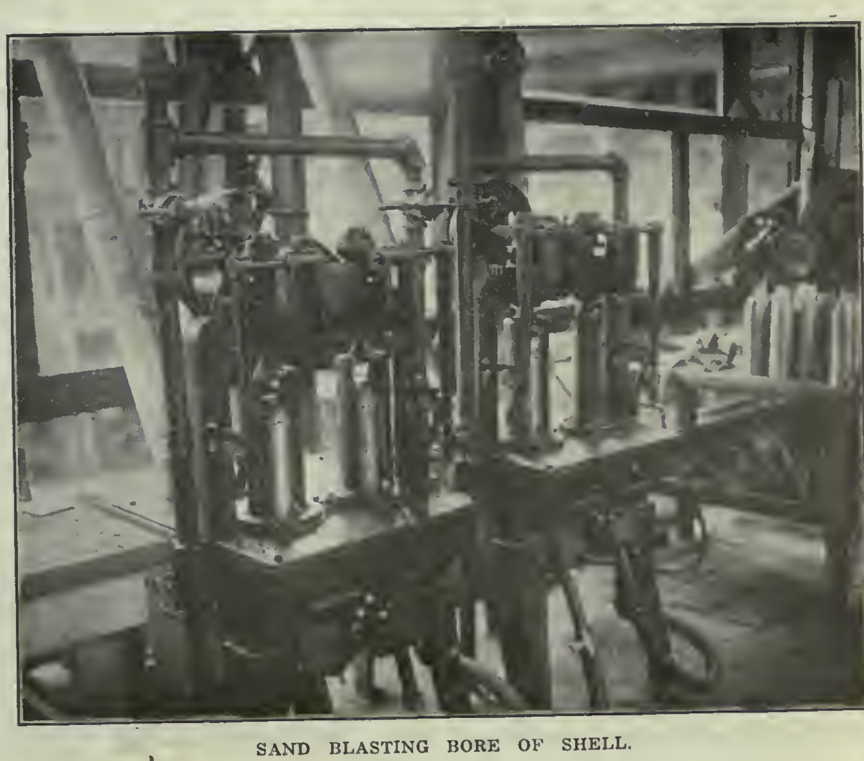
A wooden plug is screwed into the nose after the threads have been greased with vaseline. The shells are then packed nine in a box and shipped.

Final Inspection

The final government inspection is made after the varnishing operation. All shells are carefully examined, weighed and gauged before shipment. The mean weight of a 75 mm. shell finished without the fuse, is 9½ lbs. with 9 ozs., tolerance between the high and low limits. All shells are gauged after each operation.

The air chucks referred to above were supplied by the Manufacturers Co., Chicago, and the collet chucks by John Bertram & Sons, Ltd., Dundas, Ont. The shells are moved from one operation to another by means of trucks holding 112 shells each. The trucks were supplied by the Lansing Co., Lansing, Mich., and also by John Watson Mfg. Co., Ayr, Ont.

Electrical Fittings, Engineering Plants and Accessories, Metal Works, Etc.—A well known English manufacturing firm wish to get into touch with good Canadian houses willing to act as their agents for definite territories in the following lines: Electrical light fittings, engine details for automobiles, aeros and marine work, machined parts, sheet and tube metalwork, architectural and art metalwork, wrought ironwork, engineering plants for electrical power, pumping and other purposes, heating, ventilating and cooking plants and accessories, automobiles, etc. (Address British Trade Commissioner in Canada, 367 Beaver Hal' Square, Montreal, referring to British Trade Inquiry No. 3003.)



SAND BLASTING BORE OF SHELL.

OPTICS AND MECHANISM

By A. L. Haas

The matter of precision and the ability to work to fine limits is intimately bound up with the means open for exaggeration and multiplication of error. Indeed, fine work is only possible by extending the range of normal vision to detect the infinitesimal. Magnification steps in to the aid of the limited human senses of touch and sight and large scale reproduction is the only means open for comparison of small differences. Whitworth relied upon touch, or as the mechanic terms it, feel, and when he utilized a gravity piece to render difference in feel immaterial, he referred the matter of exact size to the impartial pull of the earth's mass.

Vision Extension

Mostly, however, precision is a matter of vision extension; although the old-time mechanic by trained touch obtained exact duplication within very small limits, and so obtained comparative size, he was for want of vision unable to determine end length.

The sense of vision has a very limited range with any certainty, perception stops long before the minute differences which are of mechanical importance are reached; hence extraneous aid must be given that these are appreciated and more especially determined.

All recent precision advance has been done by the application of optics to determine inexactitudes. A beam of light is the straightest thing known or imaginable and magnification originating in astronomy and microscope has received vast study from mathemetician and scientist. At present the field of optics as applied to the mechanical industry is perhaps the most fascinating of all the engineering combinations yet effected.

The Engineer's Position

One remarkable thing about the engineer is that he occupies the centre position in the web of science. He makes contact with the fringes of almost all material activity and takes and leaves at pleasure all the discoveries made in other quarters; and because such is his mission, wrests them to ends of direct practical utility.

This peculiar position has led to some hybrid activities. There are chemists with very fair mechanical knowledge, engineers versed in chemistry, chemical engineers who design and install the apparatus for chemical manufacture on a large scale.

There is also the side of materials; the specialist chemist who is termed metallurgist is often remarkable for his mechanical skill, while most engineers have at least a nodding acquaintance with metallurgy.

A Rare Combination

The combination of engineering and optics is rather rare, yet the mechanical expert with a mathematical turn will find in the subject of optics not merely an interesting hobby but one directly applicable to the problems of precision. Optical apparatus is the province of the instrument maker from whose ranks sprang James Watt, the patron saint of the engineer.

The marriage of mechanism with optics should give the mechanical industry,—indeed has already, and is still giving it—apparatus whose refinement magnifies error and determines infinitesimal size. It is a most promising field certain to afford considerable expansion in the near future. A beam of light is an exact straight line, a perfect mirror is a plane surface, angles can be determined by stellar observations and all easily determined and checked to an accuracy undreamed of in mechanical practice.

A Question of Apparatus

The sextant, level and theodolite need reapprehension in an infra-sense into the realm of the machine shop and while the problems and apparatus involved are complex, they are yielding to patient treatment. One thing certain is that the basis of mathematics as it concerns optics is already a well worked field so that it is more the practical determination by suitable apparatus which is in question.

The dial indicator, the micrometer, the measuring machine enlarged vision and determined fine errors; optical means may be expected to magnify such determination a hundredfold, making such determination more absolute pro rata.

The work of the N.P.L. in this realm deserves nothing but unstinted praise, and a large extension to engineering optics will be of the greatest value to the industry at large and the greater perfection of its product.

ACID RESISTING IRONS

By V. R. O.

The chief acid-resisting irons are silicon alloys, containing up to 15 per cent. of silicon. They are known under different trade names, such as Tantiron, Ironac, Duriron, etc. They are characterized by extreme hardness, which renders it impossible to machine them. Apparatus involving their use should be of simple form, and should not require any machining, except perhaps, facing by grinding. Their tensile strength is low, and they should not be subjected to high pressures. They are brittle, and a 4 per cent. silicon-iron shows a cubical crystal surface when fractured. There is considerable difficulty in casting to avoid soft patches. The effective life of a concentrated nitric acid pump may be as long as six months. The metal takes a very high polish and does not rust. Thick castings cannot be produced as internal stresses cause fracture.

The following are typical analyses of (1) Duriron and (2) Tantiron:

		Per cent.
(1)	Silicon	14 to 14.5
	Manganese	0.25 to 0.35
	Total carbon	0.20 to 0.60
	Phosphorus	0.05 to 0.10
	Sulphur	under 0.05

Melting point 2,550 deg. Fah. Sp. gr. 7.0. Compression strength 70,000 lb. per square inch Tensile strength 25 per cent. less than cast iron.

		Per cent.
(2)	Silicon	14 to 15.
	Sulphur	0.05 to 0.15
	Phosphorus	0.05 to 0.10
	Manganese	2.0 to 2.6
	Carbon (graphit)	0.75 to 1.25

Melting point about 2,550 deg. Fah. Sp. gr. 6.8. Tensile strength 6 to 7 tons per square inch.

C.P.R. DISPLAYS RESOURCES OF CANADA

Visualizing in a striking manner a large number of the diverse natural resources of Canada, the C. P. R. has just opened to the public an exhibit at the Windsor street station, Montreal. This exhibit, which is situated in a room immediately adjoining the main entrance to the station on Osborne street, has been prepared by the collaboration of the Quebec Government and the C.P.R.

One half comprises the Quebec exhibit, consisting of samples of the resources of the province—lumber, asbestos, and other minerals, grain, maple sugar, furbearing animals, such as the ermine, marten, mink, fox and beaver, and fish and game birds.

The C.P.R. exhibit has been gathered from the entire Dominion. A splendid display of grains produced in the fertile fields of Western Canada is a special feature. Supplementing this is a big collection of fruits, forestry products and minerals. A number of colored transparencies show the methods used in developing the forest resources of Canada, from the primary state to the finished product, such as wooden ships. Other transparencies illustrate some of the summer resorts along the company's lines. Complete and recent statistics of all the country's resources add conviction to the display. The exhibit is installed in handsome showcases, brilliantly lit; and it is interesting to know that all the material used in the construction room is Canadian material exclusively.

RESEARCH DIVIDENDS

The great laboratory of the General Electric Company at Schenectady is maintained at an annual cost of over $500,000 and employs seventy-five investigators, including among them several who are eminent in the world of pure science. One of the products is the tungsten lamp which is now manufactured by twenty-two factories scattered over the country. This lamp, according to a very careful estimate made in 1911, was, at that time, effecting a power saving valued at $240,000,000 per annum. Since then the consumption of this type of lamp has increased threefold and further research has increased its efficiency of light production nearly 25 per cent. The research workers are discouraged from thinking of financial results, as discoveries are more likely to be made by those who are working in the scientific spirit.

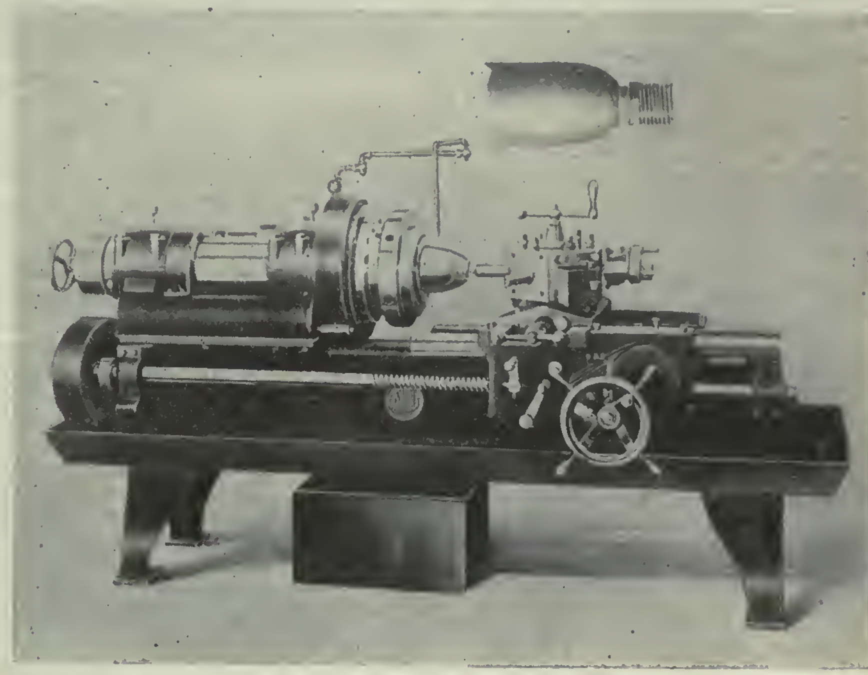
DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

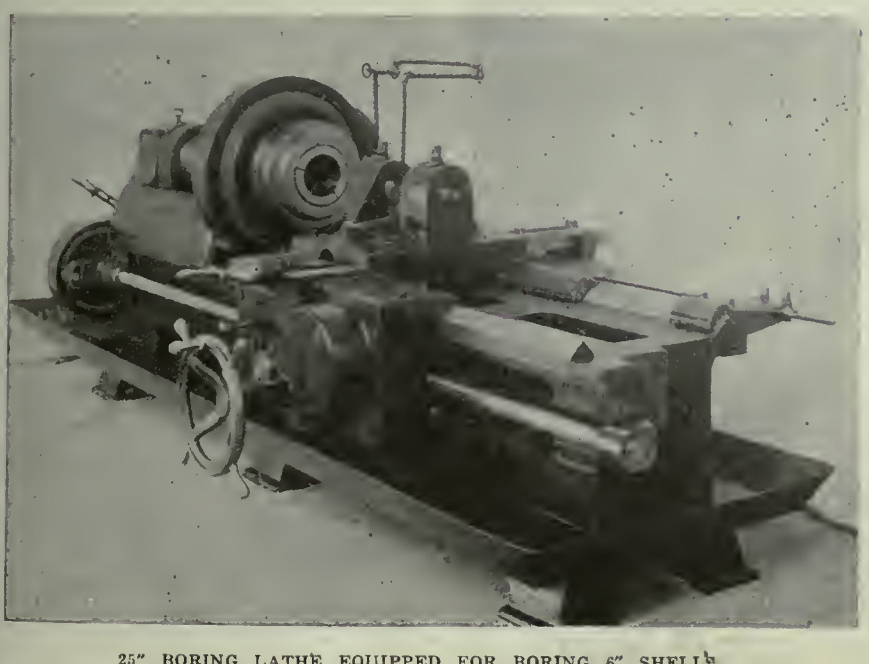
SPECIAL BORING LATHE IN VARIED MODELS

SHOWN in the accompanying illustrations are two of the several types of special lathes developed for shell work by the Gisholt Machine Company, Madison, Wis. Many of these machines have been built for shell work and are now installed and operating in munition plants in England, France and Italy. At the present time several lots are going through the factory and are destined for American shell shops, some being of the 25-in., and others of the 16-in. machine, both of which are shown. Though designed for shell work they are adaptable for other purposes. The 25-in. machine illustrated is one of an installation to be used in boring 6-in. or 155 mm. shells.

In one of the accompanying illustrations is shown a sketch of the 155 mm. U. S. howitzer shrapnel, and also one of the 155 mm. U. S. high-explosive shell. The letters A. B and C in the case of the shrapnel and A, B, C and D in the case of the high-explosive shell indicate the finished surfaces on the inside of both shells which can be advantageously handled on the new lathe, using either a single point cutter in the boring bar with a former block on the taper attachment, or boring heads located on the boring bar, and with the cross-slide carriage set central. The taper attachment is shown on the back of the machine.

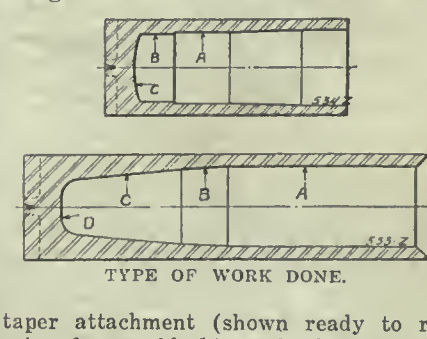


16" SIMPLIFIED LATHE EQUIPPED WITH COLLET CHUCK AND TOOLS FOR BORING AND THREADING NOSE END OF SHELLS UP TO 155-MM.



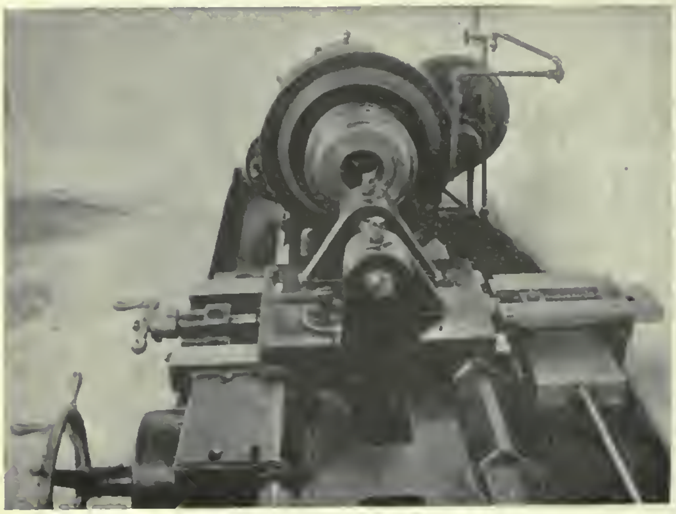
25" BORING LATHE EQUIPPED FOR BORING 6" SHELLS.

Notable in the machine is the rigid design and massive construction of the



TYPE OF WORK DONE.

taper attachment (shown ready to receive former block), and of the cross-slide carriage which is shown ready for the boring bar. In the machine illustrated the cross-slide carriage is bored to 3 inches in diameter, although the diameter may be made to vary with the



25" BORING LATHE EQUIPPED FOR STRAIGHT BORING OPERATIONS OR WITH BORING HEADS.

requirements. Also to be noted is that the cross-slide carriage bears the entire width of the slide, which is 18 in. wide and 24 in. long.

The 25-in. machines are made in several models, some carrying turrets, others simple tool posts, etc. They may be built with collet chucks as shown, or with 24-in. three-jaw scroll chucks, or four-jaw independent chucks as may be deemed best to handle the required work. The 16-in. lathes have a 3¾-in. and 6¼-in. spindle bore while all the 25-in. machines have a 6¼-in. spindle bore. The several models make possible combinations of chucks and carriage equipment adaptable for a wide range of work in general manufacturing as well as in the production of shells.

26-INCH SHELL BORING LATHE

The accompanying line drawing illustrates a recently designed lathe specially adapted for shell work. The bed is of particularly heavy construction, 24 inches wide, 18 inches deep, with an overall length of 10 feet, 6 inches. The head stock is made very rigid and is fitted with extra large bearings, the front being 15 inches in diameter and 12 inches long, and the rear bearing 6 inches diameter with a length of 10 inches. The spindle is fitted with an air-operated collet chuck, the pneumatic cylinder being located at the rear of the spindle. The power drive is very effective, the main pulley being 20 nch belt. Motion is transmitted by a train of heavy cut gears, the first pair having a face of 3½ inches of 4 d.p. and the second pair 4-inch face with a 4 d. p.

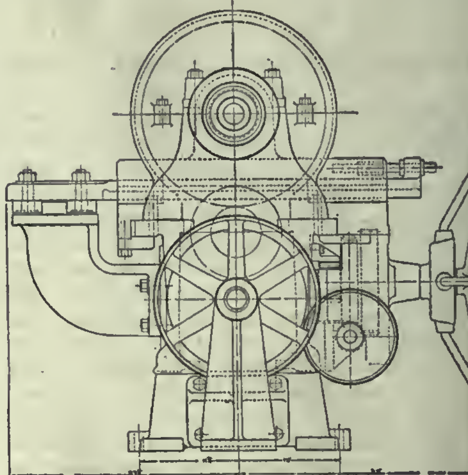
The carriage which is 36 inches low, is fitted with adjusting jibs at the back and the front. The feed rack is of extra strength, having a face of 2½ inches with 3 d. p. Carriage feed is of the friction type, a face with a contact of 1¾ inches by 9 inches diameter. This is located in the hub of the pilot wheel. Feed is obtained from a two-step pulley using a 3-inch belt. The carriage apron is of the heavy double plate type, back geared plate made of steel with bronze bushed bearings. The spindle thrust is taken by a special ball bearing fitted to the forward end of the rear bearing. The approximate weight of this machine is 10,000 pounds. The cut shows the lathe adapted for shell boring, but it can be readily converted for rough or finish turning by changing the attachment on the carriage. The machine is fitted with a profiling fixture and can be supplied with a turret if desired, by the manufacturers, H. W. Petrie of Montreal, Ltd.

7.5 MM. BORING LATHE

The Canada Machinery Corporation, Galt, Ont., has recently placed on the market a lathe for boring 75 mm. shells. The design of the lathe is new and was developed by this concern after an extended experience in the manufacture of shell making machinery. This lathe is of substantial construction, an essential feature in machines of this type, while it is also simple in design and easy to operate.

The bed is unusually deep and heavy and is made with solid cross bridges. It is also built with two large flat sheers on which the carriage traverses, ensuring ample wearing surface. The head is of strong construction, ensuring great rigidity at all times.

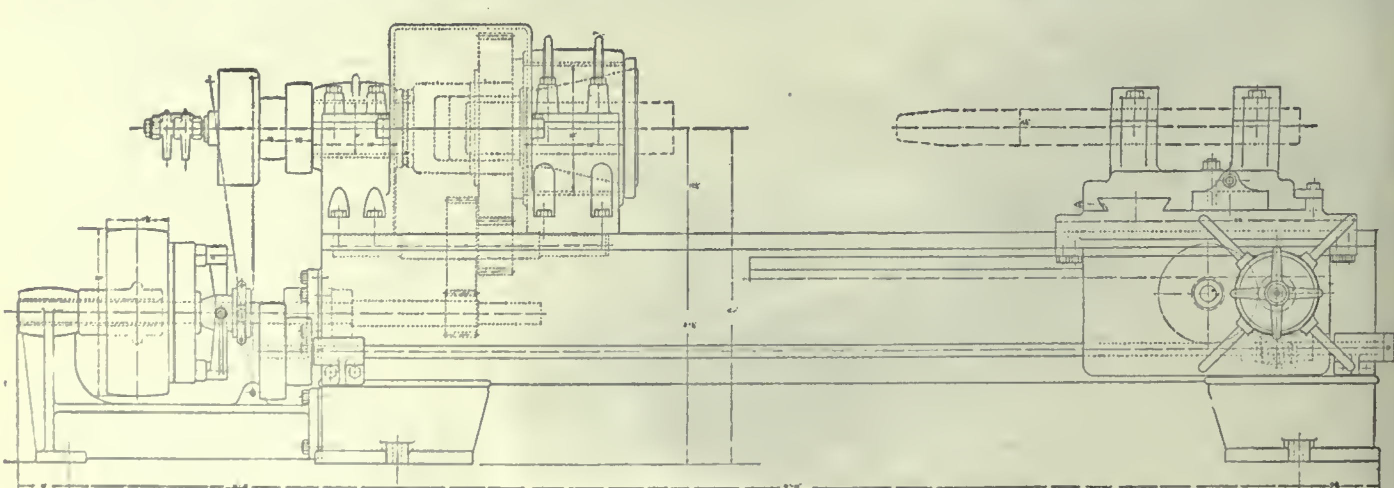
The spindle is a semi-steel casting of large size and is provided on one end with a compressed air cylinder operating a collet chuck. This chuck is controlled by a conveniently situated air cock and is so arranged that it extends within the



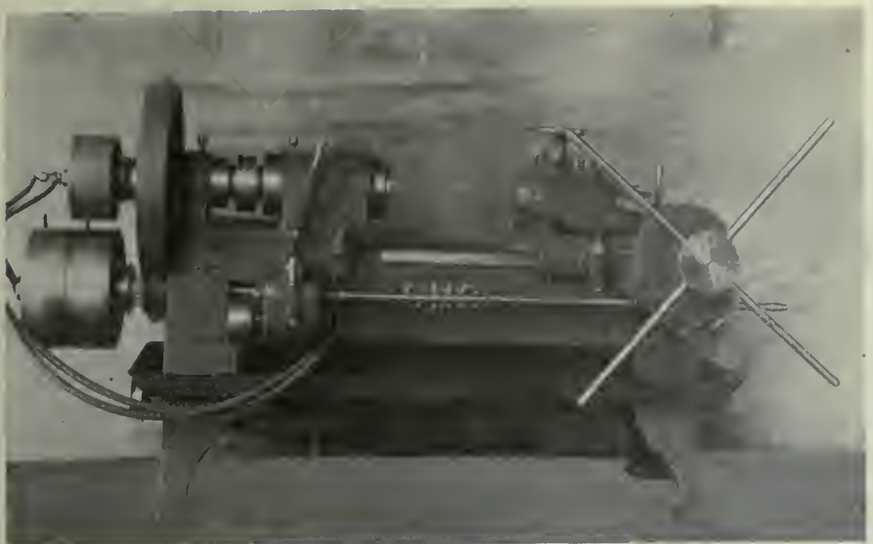
26-INCH SHELL LATHE. END ELEVATION.

spindle, thus bringing it within the front bearing, ensuring rigidity. It is instantaneous in action and will keep its alignment under the heaviest work. The spindle has taper bearings which are of large size, the front bearing being 7 inches diameter by 12 inches long and the back bearing 5½ inches diameter by 5 inches long, provision being made to take up the wear. One spindle speed only is provided on the regular machine but a two-speed countershaft can be supplied, at an extra cost, which will give two speeds of desired range.

The feed to the carriage is simple and efficient, obtainable by means of a feed rod which carries a heavy worm, which



26-INCH SHELL LATHE. SIDE ELEVATION.



75-MM. BORING LATHE.

by means of a conveniently situated lever engages a worm wheel and pinion operating on the rack bolted to the bed. This feed rod is driven through a two-speed gear box, which, in operation, is driven by a belt from the spindle. The feed, being thus belt driven, offers particular advantage over a positive driven feed insomuch that it may be left engaged to assist the operator in the difficult bottoming operation, which is impossible with the positive driven feed, thus increasing the speed of this operation.

An automatic trip is provided in addition to the hand trip. This trip is set at the desired point and the bars in the turret set for the correct depth.

The turret is mounted on a cross slide on the carriage and is solid and massive throughout. It is provided with three holes to hold the boring bars and is traversed across the carriage for different operations by means of a rack and pinion operated by a large hand wheel on top of the turret. A suitable stop is provided for locating each bar centrally and a clamp handle is also provided for locking securely in position.

A pump of approved design is provided to supply an ample and constant flow of cutting lubricant to the boring bars and the piping is so arranged that the bar which is working is the only one to receive this supply. A steel oil pan is provided to collect the cuttings and to return the cutting lubricant to the pump.

The gear ratio of drive is 5.17 to ' The fast and loose pulleys are 16 inch diameter by 5¼ inches face, the speed being 5.75 r.p.m. The holes in turret are 1 15/16 inch diameter. The weight of the machine is 3,000 pounds and floor space occupied 3 feet by 8 feet, cubic measurements, 150 cubic feet.

OVERHEAD CARRIERS AND HOISTS FOR MUNITION PLANTS

Adequate means for the handling of shells as they pass from one machine to another is a big factor in quantity production and an item which affects the balance sheet to a large extent.

The tracks conveying devices manufactured by the Richard Wilcox Co., London, Ont., have the advantage of years of prior development and experience in their production. The track used for the shell is a trolley track made up of a formed tube of sheet steel totally enclosing the carrier. These tracks are furnished in any length and adjustable brackets are furnished for support. The track section permits the use of switches, curves and turntables to any desired extent.

The carriers are made in plain or ballbearing types and for extremely heavy loads a sufficient number of carriers are linked together for strength and flexibility.

DETAIL VIEW OF CHAIN BLOCKS AND CARRIERS.

In the installation shown the shells are passed from one machine to the other on tables but are picked up off the table and placed on the machines by the block and tackle suspended from the carriers.

KNURLING MACHINE FOR 75 MM. SHELLS

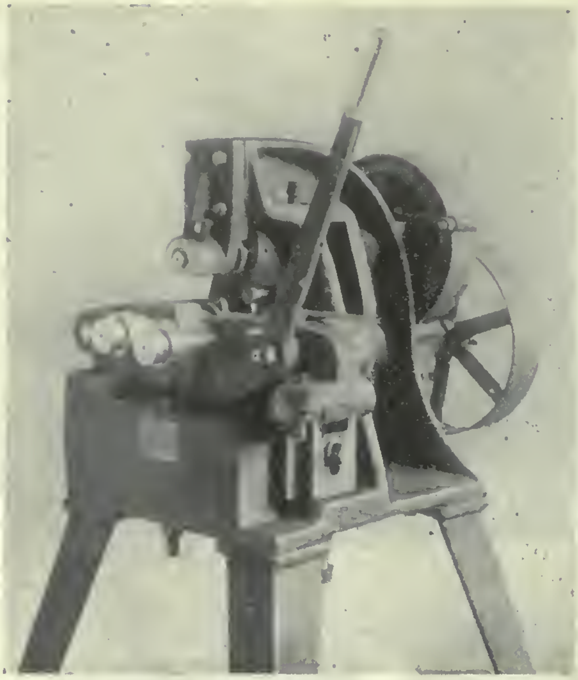
The Canada Machinery Corporation, Galt, Ont., has designed a new machine for rolling the knurl on the seat for the copper band on 75 mm. shells. The machine has already achieved considerable success, for it is being used by four of the largest makers of 75 mm. shells in Canada and also by a number of firms in the United States. The machine is also being built to use for the same purpose on 4.5 inch and 155 mm. shells. By substituting plain rollers for knurls the machine can also be used for rolling smooth the bourellet on the millimeter sizes of shells.

ARRANGEMENT OF CHAIN HOISTS AND CARRIERS SERVING LATHES.

The machine is of simple but strong construction as will be seen from the accompanying illustration. The operation of knurling is done as rapidly as the shells can be handled, the mechanism being so designed that no chucking is necessary, thus resulting in high production.

When the shell is placed in the machine it rests on a pair of adjustable cradles with its base up against a stop on the head to locate it in the correct position. A lever which is in a vertical position is then pulled down to the horizontal, this motion lifting a cradle or yoke which carries the two lower knurls and outer rolls. A steel eccentric 2½ inch face, acting on a roll of the same width, operated by the lever, which is 2 feet long, brings the shell into contact with the knurling collars. The outer rolls on the lower knurling spindles, referred to above, hold the shell in line while in operation. The motion of the yoke is governed by means of an adjusting screw located at the front of the machine.

The upper knurling collar only is driven, the lower knurls revolving by friction. The knurling collars are 2 15/16 inches diameter with 3/16 inch face, the



KNURLING MACHINES FOR 75 AND 155-MM. SHELLS.

upper one being driven by a 1 5/16 inch spindle running in long phosphor bronze bearings while the lower knurls are fastened to steel spindles running in bearings in the yoke. The spindle carrying the upper knurl runs at 100 r.p.m. and is geared up to 300 r.p.m. at the driving pulley. The outer end bracket bearing of this spindle is removable for changing knurls.

When the knurling operation has been completed, the lever is raised up, the lower knurls come away from the shell which now rests on the adjustable cradles. The cradles arrest the motion of the shell and hold it clear of the knurling collars while it is being removed from the machine, as is the case when the shell is being placed in the machine. The knurling machine weighs 1,200 pounds and occupies a space 36 inches by 48 inches.

When this machine is built for rolling the bourellet, plain rols are used instead of knurls. In this case all the rolls are power-driven through gears in the head of the machine. The shell is supported in the same way and the yoke is also used in the same way as for knurling. When rolling the bourellet the nose of the shell lies towards the head of the machine.

CUTTING OFF AND BASE FACING MACHINE.

No doubt 6 in. and 155 m.m. manufacturers will readily appreciate the operating advantages of the "Improved" No. 2 Globe cutting-off and base-facing machine, illustrated herewith.

In this machine, a powerful, easy drive is obtained by two sets of steel gears, 3¼ in. face, having ratios of 5.75 and 6.30 to 1. The shifting mechanism consists of a positive steel clutch of ample proportions, operated on the driving shaft by a steel lever conveniently placed. Plenty of belt surface is assured on the crowned 18 in. dia by 6¼ in. face driving pulley, eliminating the tight belt with its usual troubles. Equally satisfactory results are obtained, driving from either lineshaft or countershaft.

The chuck is integral with the spindle. Forgings are held by a simple method, sometimes called the "pot" system, consisting of 4 hardened steel set-screws of generous size. A second set of hardened steel set-screws acts as a concrete inside the spindle.

Several other minor changes have also been made.

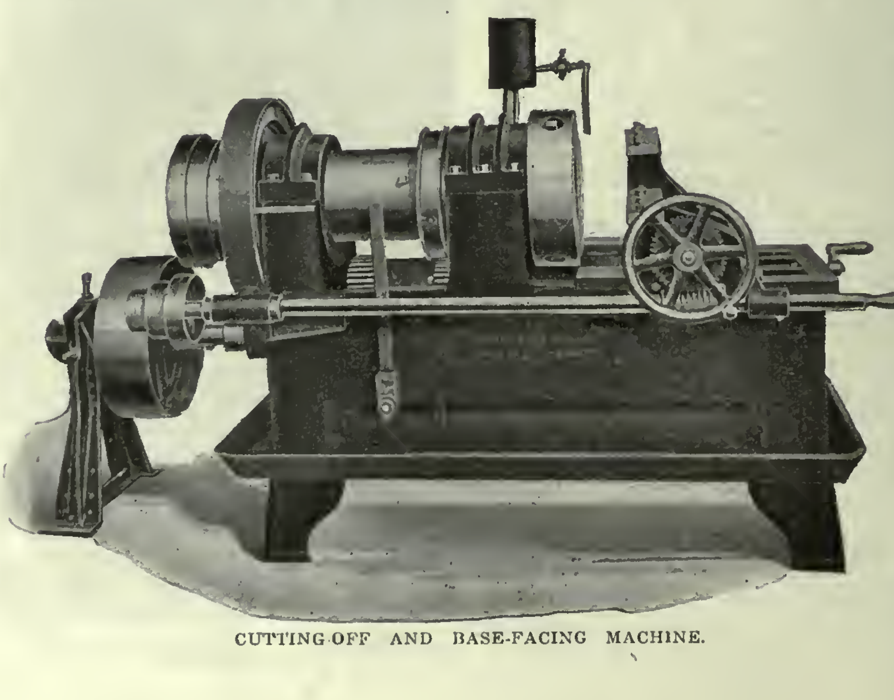
This machine is manufactured by The Globe Engineering Co. Ltd., Hamilton, Can. Additional equipment has recently been installed, making early delivery possible on further orders for these machines.

MOTORSHIP ADVANTAGES

By D. Street.

THE super-Diesel internal combustion engine will play a very important part in the near future in ship design and propulsion. This type of engine was invented by Otto, perfected by Daimler, and brought to its highest state of efficiency by Diesel and Junkers. Its operation is based on the principle of rational conversion of coal into power—in other words, it utilizes this fuel in the form of the by-products of coal, such as gas, benzol, and other inferior substances which are derived from the distillation of coal in coke ovens, gas retorts and gas producers. This method gives a distinct advantage in multiplying the usefulness of a ton of coal, resulting in a higher output of heat, light and power from the same. The values thus added to the national income are difficult to estimate. This type of engine has also opened up a new and extensive field for the exploitation of mineral oils, such as crude petroleum, etc., which formerly only had a limited range of usefulness and has set a new value on oil lands.

The oil engine has now become dominant in the navies of Europe, and the imperative need of the most up-to-date equipment applies to merchant vessels as well as those for war purposes. Motorships are coming to be recognized as far more economical than those propelled by steam, not only in economy of fuel and labor, but in the greater cargo space that the same sized ship of this type affords over that of a steam-propelled vessel. Due to the absence of boilers and funnels, motorships are clear of many working obstructions and give large unrestricted room for loading and discharging.



CUTTING-OFF AND BASE-FACING MACHINE.

CAN TAKE NO CHANCE ON SHELL INSPECTION

Defects Should be Caught Right in the Machine Making the Faulty Operation

By J. H. R.

The chairman of the Imperial Munitions Board in discussing shell making with a representative of this paper some weeks ago, made a point that is brought out in the following, viz., that each shell is a unit, and is either good or bad by itself. There is no such thing as a fairly good shell. It is either good or bad, right or wrong. Moreover, it may be the first operation or so that determines this. This article points out the need for close attention to points where the 100 per cent. efficiency standard is being broken down.

FEW problems relating to the manufacture of munitions have created more difficulties than that of inspection, and yet this important factor has often been so sadly neglected or overlooked as to result in gross inefficiency. The essential bearing that thorough inspection has to the successful production of munitions was not clearly recognized during the incipient stages of this industry, the consequence being that the percentage of rejected shells, due to faulty forging or machining, was very frequently so large that drastic measures were required to prevent an occurrence of such possibilities. One of the primary considerations in connection with the manufacture of ammunition is the high degree of accuracy that is required in the various operations; not that the working limits are finer than any hitherto performed, but that many of those firms receiving initial contracts had not been accustomed to work to the standardization necessary for quantity output.

The Supervisor's Work

Some impressions of a supervisor of inspection are set down in the following statements. "When it became apparent that all engineering concerns in Canada would be given the opportunity to assist the arsenals in producing the maximum quantity of ammunition that would be required, many contracts were accepted on the supposition of what had done another might easily accomplish. With the possible exception of a few tool manufacturers it is doubtful if more than 25 per cent. of the original shell makers had been accustomed to working to the fine limits or low tolerances required in shell specifications. With their past experience only as a guiding influence many firms failed, utterly, to realize the part which inspection would play in determining their intimate degree of success.

"It would be serving no particular purpose to enlarge very much of the number of failures brought about by the lack of foresight shown by some in their desire to ignore, or at least minimize, efficient shop inspection, but some of my experiences would have been almost ludicrous if they had not been associated with such loss of time and material, and waste of valuable highly skilled labor. For instance, in the early days of the war it was a common sight to see some shops making the most elaborate inspection of their product along similar lines to the Government and immediately before submitting to the same, while at the same time there were not enough inspectors at the different machines to check the work at a very low percentage. The result of this policy, in many cases, was that their shop inspection would send back for repairs anything from 50 to 75 per cent., and probably reject as scrap 25 per cent.

The Better Way

"By an efficient shop inspection whereby only reliable inspectors were placed at the various machines to check up 100 per cent. of the work, with full authority to immediately stop a machine at the first sign of faulty work, the following would have to and can be obtained:

(a) Operators on machines are able to give all their attention to the actual machining details and go straight ahead without the anxiety of knowing whether he was making bad work or not, as the inspector would be the person who would at once stop him on the first appearance of defective work. The tool-setter or foreman would become immediately acquainted with the trouble, so that the tools could be adjusted or repaired, or altered to suit the required conditions. Where the machine is at fault it may be necessary to stop the same until such time as it can be fixed or replaced. By this practice it is virtually impossible for spoiled shells to accumulate between machining operations.

(b) When shells have to be rectified a considerable part of the profit is lost on the shell, and good men's time is utilized in repairing the same when it might be better applied to the country's needs in other branches of engineering. Very few firms stop to consider the cost of this repair work, the machine installation required, and the number of shells that are returned for repairs, many of which eventually find their way to the scrap heap.

(c) A shell when lost in the machining means that a shell has been forged for nothing; surely this alone is a loss to the country in fuel, material, and labor, and involving the additional work required in replacing the shell that has been destroyed.

A Dangerous Trick

"Some superintendents are apt to exclaim—'We can afford to lose five per cent. scrap'—but never stop to consider how they are going to regulate it at the said five per cent., for as each shell passes through exactly the same sequence of operations it is obvious that if a bad piece is produced from a machine it is logical to assume that the same fault will occur on the next piece or subsequent shells at this specific operation, and considering that in the manufacture of some types of shells there are from 35 to 40 different operations, there is every opportunity of making 25 per cent. of scrap when the management are satisfied to tolerate a five per cent. rejection. A far better viewpoint is to look for 100 per cent. perfect, and even with good inspection, the best tooling, rigid machinery, and above all positive stops, errors are almost certain to occur, so that on the expiration of the contract if it is found that three per cent. has been rejected by faulty machining and in the Government inspection, the firm getting such results can feel highly satisfied.

Must Have Control

"To obtain these results requires an investment of five per cent. for inspection, in relation to the value of the article, providing the following conditions are adhered to. Procuring a man in charge of inspection controlling an organization entirely separated from the production department; that is, the man must be an engineer and thoroughly capable of taking responsibility, and guaranteeing absolute first class work to the directors who engage him. He must have a free hand to control any machine or group of machines, which is making material contrary to the drawings or specifications.

"By maintaining a very high quality of work throughout the shop further inspection of the finished article is hardly necessary except where parts are liable to become affected by subsequent operations. With detail inspection the great advantage to be derived is the regular flow in large quantities which pass through the Government inspection showing a minimum of defects, and is the state in which the Government expect it to be in when it reaches this department, as most Government inspectors have a very strong objection to performing inspection work for the company making the shells—work that should have been done in the shop, or further at the very machine that performed the operation for which the shell has been rejected. Slight errors, and cases where the operators consider they will take a chance, often exclaiming—'That is good enough'—will eventually lead to trouble before the shell passes the final Government inspection. The rule for inspection must be to insist on perfection of the product at each machine and in every detail, and then and only then will the contractor get the results which he hoped for and expected at the time when he took the contract."

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Are Standing the Test Well.

ALTHOUGH reports that have been spread for some time might lead Canadians to expect a falling off in the number of shops operating, reports of closings are few and unusual.

So much was heard of drawing the deadline between essential and non-essential industries, and closing off the latter, that drastic measures were always supposed to be just around the corner.

As a matter of fact Canada's war performance is demonstrating that her industries, for the most part, are not of the non-essential kind.

The very fact that so many of them are being recognized by the War Board when they want to enter the market for supplies is sufficient proof of this. In many cases, although a shop may not have a direct contract, it is working on a sub-contract, and in this way helping to speed up production.

Some of the foundries making lines "that can wait" are suffering from a lack of pig iron or scrap of good enough grading to make a fit substitute.

On a broad scale, though, industrial Canada is standing the acid test of essential or non-essential in good shape. It is good evidence that Canada's industrial life is based on concerns turning out necessities rather than things that people imagine they want, but in reality are much better without.

Can You Run a Quarter Mile?

DOES the average man take care of himself? The individual might be inclined to answer such a query in the affirmative, but having given the nod of the head, he might have quite a time convincing any person else that he was right.

Here's what one real authority has to say of the matter: "Words are inadequate. Neither tongue nor pen can do justice to this subject. The average man would puff and blow like a porpoise if he attempted to run a quarter of a mile. He would be stiff and sore for days if he walked five miles at a brisk gait."

And the chances are that the man who made that statement was mighty close to absolute fact. Here and there is an exception to the case, but these exceptions are conspicuous by reason of their rarity.

If men were asked why they allow their muscles to become soft, flesh flabby and joints wheezy, they would have an array of excuses that would shape up fairly well. But sifted out, it would come to "Can't be bothered."

"Can't be bothered" in reality accounts for a heap of stuff that manages to crawl away under some other guise.

The man in the city is in many cases a poor prune when it comes to physical fitness. He rides in his auto or on a street car to work, rides to lunch, rides home, and imagines he's a regular bang-up Adonis if he can cut the lawn and carry out the garbage without having a vacation between the movements.

But when it comes right down to brass tacks there are few people who bother keeping in shape. The loss is to themselves, to their employers and the nation. And in the aggregate the loss in efficiency to the nation is staggering, for no man can allow himself to degenerate into a jelly-fish and keep the consequences entirely to himself.

Paving the Road For High Prices

THE following is a sample of the stuff that runs the gauntlet of the Ontario press every few days:

> Ontario housewives will have to go a little light on preserving this fall as the fruit crop of the province has turned out very poorly. Cherries, plums, pears are all very scarce, and apples did no do so very well, either. Peach trees in the Niagara peninsula were killed by the frost to the extent of about 10 per cent.

Cherries are the first on the list to reach the market, and there are cherry trees all over the country breaking for the want of some person to pick the fruit.

The same talk of winter killing of peach trees gets hatched over in the Niagara belt every year just as sure as the water runs over the Falls. Niagara's fruit correspondents would indeed be a flotilla of lame ducks if they couldn't get that old winter-kill story out of cold storage and let it prance around a little every spring and summer.

What's the idea? To get the people ready to pay top prices for fruit? Or to get them at the stage where they'll grab at the first grist of colic apples that get peddled inside the city limits? Or to educate 'em so that green gooseberries at 20 cents a quart will look like an 8.30 bargain, well worth grabbing for?

The prices for fruit, between the embargo and the price grabbers, will be high enough, without the press getting up on its hind legs and hollering in advance that the housewife had better be prepared in advance to be mulcted to the limit for every pint of fruit she manages to tuck away in the cellar for winter use. She knows mighty well it will happen without papers going to the trouble of putting grease on the skids for the price boosters.

Our idea of good luck is for a family to go through the cherry picking season without any of the members carrying a broken leg in a sling.

Before you start a strike, make certain that it isn't going to make it easier for the German troops to do the same thing in a different way.

It's a fatal mistake for the man who has been operating an automatic machine to imagine that as a mechanic he's not far removed from the expert tool maker.

A man with a mania for figures has it that about 12 million men of all armies have seen front line service, and of this number, according to reports from the various capitals, some 18 million have been taken prisoners. Statistics are surely interesting and instructive.

Your War Contracts Will Stop Some Day

THE manufacturers of Canada who can line up with the war group have little to worry about at present in regard to business. They can get it—all they can handle. And the great percentage of it is in the line of repeat operations and long runs.

There is no need to worry about the sales and collections. The only trouble about the latter is at times in the matter of adjustment for rejects and the labor loss necessary to find the defect that makes the rejection necessary.

Are the Canadian firms, the steel and iron concerns, the machining plants, big and small, living in the present alone, or are they looking to the future? The fact that you have been a success in turning out war orders is not proof positive that you are going to be a success when the war work closes and you have to get out and hustle for business in the open market.

The real test of Canadian efficiency has not yet come. It is coming in the future.

Remember this. Industrial plants in Canada are keyed up for production—for very large production. They have turned out an amount and a quality of which they can be proud. Canadians were afraid of munitions business when it was first a possibility. They shivered at the fuse game. But they went in. They turned out successful. They made munitions for Canada, for Britain, for United States and other Allied nations.

But don't get away from this. This "keyed-up" process has not been common to Canada alone. The plants of other nations are under the same strain.

Their organization, built to fight the same battle as we are fighting, will, at the termination of the war, be out to meet us in open competition for our own markets and the markets of the world.

If their production methods are better than ours—if they can make better goods at our price—if they can make equally good products at a lower price—the Canadian industrial world is going to be in for hard sledding and a poor session.

The Canadian munitions producer with the big organization has the government as the responsible party to pay the bills—it has as its sales force the dump cart of war need at its factory door, and the dump cart has been backed up there for a good many months.

Now, then, look ahead. When the government ceases to order, and the dump cart moves away, what is going to happen?

Unless the firm has kept its production costs on a level, or something approaching it, with peace time, competitive prices—unless efficiency has marched along with this great volume of business—there is going to be a season of discharging hands that will make the employment office dizzy.

This is not alone the opinion of CANADIAN MACHINERY. *It is the belief of some of the very best leaders of industry in Canada at the present moment.*

Men who realize this are men who see in the present volume of business not simply an opportunity for profits, but a responsibility for maintaining the industrial and labor equilibrium in the period following the end of the war.

The men who do not and will not realize this situation are those who rush into the labor market and take 500 hands—use them as long as it suits their purpose and immediately after fire them into a glutted labor market. To them there is no human side in industry. To a large extent they undo the work of manufacturers whose chief delight is in the welfare of their men, and make it doubly hard to kick down some of the nasty barriers that fanatics persist in building up between capital and labor.

Right now, when business is good—when you can afford to do it—look ahead.

Don't wait until the Allied governments come around and say, "Gentlemen, we have no more war orders. You will have to do something else now or close up your shop."

Don't be caught. Don't have to tell a deputation of your workmen that you don't know on what date your plant will re-open.

MARKET DEVELOPMENTS

Hot Weather Not Helping Production

Hard on Men at Furnaces and Rolling Mills—Brisk Demand For High-Speed Steel—Scrap Situation is Not Showing Any Signs of Improvement

THE weather has been much against high marks in production in the steel, iron or rolling plants during the week, and it is only fair to assume that the figures have shown a falling off. Against this, however, there has been a season of fairly cool weather, making good production possible and quite easy to maintain.

Reference is made in several despatches from American points to some Canadian bars having been sold to non-essential industries in the New England states at a price above the figures fixed by United States government. One of the steel trade men of Canada who knew of the case in point said that the affair took place some time ago—in fact the beginning of the deal was at a time before United States entered the war, and the amount in question was not large. He made it plain that the practice is not now carried out, and expressed surprise that the incident was deemed of sufficient size to ever get into print.

Plants turning out pig and steel have quite a problem in keeping the fine balance necessary in the disposal of their output so that the foundries and machine shops shall be equally well served.

The question of the supply of scrap is coming to the front more than it has ever done before both in this country and United States. In the Republic there is a regular combing-out process in operation for old material, and a determined effort is being made to bring it all from any of the hiding places where it may be taking cover. But the railroads are holding tight to old cars, locomotives, etc., and they are also abandoning a much smaller quantity of old rails than formerly. U.S. mill men are also raising another point that does not occur to the casual observer. Many of the plants forging American orders in Canada are served with U.S. steel. These are machined in this country, and the scrap turnings from all this is used up in this country, thus denying the American mills of considerable material. The plate mills are still the favored lot in the war group, and continue to draw a very large tonnage of raw steel. The effect of this is that rod and wire mills are running only about 60 per cent.

Dealers in high speed steel are doing a big business now—in fact the chances seem to be that their high figures for volume of trade are being touched this quarter. There are many plants just on the verge of the production stage, and when this is the case the demand for high speed is brisk. This condition, added to the number of plants already operating, and the scarcity of skilled men, makes a situation that is very favorable to the dealers in high speed goods. Rumors were heard of a new list on carbon goods, but it has not yet materialized.

THE HOT WEATHER HAS A TENDENCY TO PULL DOWN PRODUCTION TOTALS

Special to CANADIAN MACHINERY.

MONTREAL, July 22.—The hot wave of the past few days coupled with the general holiday season, has acted as a quieting feature on business generally. As is usual under these conditions the steel mills and foundries have been forced to curtail slightly on production. Continued activity in the munitions industry is still a feature. Some plants under construction are nearing completion and in a few weeks operations, are expected on a production basis. For this reason the machine tool trade is quite active and manufacturers are exceptionally busy in making the desired equipment, the bulk of which will be made in local plants. Old materials are quiet with scrap metals firm and stronger.

Hot Weather Affects Mills

Conditions are relatively unchanged from those of the past few weeks. The demand or rather the requirements continue quite heavy, particularly for ship yards and the munitions plants. Local rolling mills have been affected by the extreme heat of the past few days and the tonnage output has suffered somewhat in consequence. However, the favorable weather during the earlier portion of the month enabled them to maintain production at a good figure, so that unless the hot spell is prolonged the mills anticipate an early return to previous activity. Several steel foundries are again busily engaged in making billets for the 9.2 inch shells and other sizes.

Plants working on the machinery of the large shells are well under way and are rapidly attaining the steady production stage. A feature that may serve as a basis for an early revision in the distribution of Canadian steel supply, is the report that some steel has been disposed of to firms in the States that are not duly entitled to the same under present conditions. If investigation proves such to be the case the Government may take steps to prevent a recurrence of the movement Dealers here report a steady enquiry with slightly better delivery on material coming from United States mills. Quotations are firm and well maintained.

High Speed Steels Active

Now that many plants are nearing the production stage on American shell contracts, the demand for high speed steels is showing a relative increase. Local manufacturers of small tools, such as cutters, reamers, etc., are very busy, and as stated by one large concern—"The apparent shortage of skilled labor for the making of tools in shell plants, has added to the demands upon the small high speed tool manufacturer, so that our business in this respect has shown a steady increase." Prices are steady and well maintained at about $2.25 per lb.

Metals Steady

The general metal situation is without feature. Copper is higher and supply is scarce. Tin is still uncertain but price is unchanged. Spelter has weakened. Lead is dull.

Copper.—The market here has a strong tendency owing to the fact that metal is hard to obtain. Little American copper is available while the general demand is good. Dealers are now asking 30½ and 31½ cents an advance of ½ cent per lb.

Tin.—The supply of tin here is ample to meet immediate requirements but dealers state that delivery of metal is very indefinite. The quotation of $1.10 is still maintained but is a nominal figure.

Spelter.—A quiet week in spelter has resulted in a weaker market, as reflected in a ½ cent decline locally. Dealers here are now asking 11 cents per lb.

New Machinery Desired

The demand for machine tools at the present time is quite active, not that many new orders are being placed, but the requirements for several new munition plants are receiving considerable attention. In the aggregate the bulk of this equipment will be of the special purpose type, and much of the machinery for the local plants is being constructed in the city. It is notable that, with few exceptions, the bulk of inquiries is for new machines, some few that have seen service have been disposed of. Dealers report an active effort on the part of certain holders of old machinery to offer them for sale, tempted by the condition of the market, but as a lot of this is unsuited for existing conditions, the dealers are not inclined to handle this business. Owing to the abnormal demand for supplies now existing in the States, dealers report some difficulty in getting delivery on equipment coming in from American points. Canadan small tool manufacturers are particularly busy at the present time.

Some Scraps Scarce

Apart from the marked scarcity in some scraps the situation is comparatively devoid of feature of any kind. Dealers report a steady but quiet business. Slight increase has been noted in the non-ferrous field and dealers are asking prices, for old copper, slightly in advance of last week. Crucible and heavy coppers are up another cent, the price quoted being 24½ cents. Composition turnings are ½ cent stronger at 23 cents. Medium brass is quoted at 13 cents, an advance of one cent per lb. Scarcity of cast iron, both machine and stove plate, has made these markets stronger. The former is quoted at $35 and the latter at $24 per ton, the advances being $1 and $5 respectively. Heavy lead is now quoted at 8 cents, an advance on the week of one cent per lb.

POINTS IN WEEK'S MARKETING NOTES

Toronto dealers state that the demand for high-speed cutters is greater than ever.

Steel and iron plants have a problem trying to dispose of their supply so as to keep the proper balance between pig iron and steel.

Heavy melting steel and machinery scrap are much in demand. Not much comes to the market as the government takes the munitions plants' scrap, and many large firms sell directly to the trade.

Copper producers are not satisfied with the new price and are working for a figure around 27 or 27½c. The price standing for some weeks before that was 23½c.

A Pittsburg despatch states, "the country is being combed for old material." This helps only a little as railways are holding tight to old cars and locomotives, and abandoning smaller quantities of old rails.

United States points claim that much unfinished steel is leaving the country, and being finished inother countries, thus depriving U. S. of the scrap metal from the process.

Plate mills are drawing an unprecedented supply of raw steel, making it more difficult for other plants to get a supply. Rod and wire mills, sheet mills, merchant pipe and bar mills are not drawing 60 per cent of their former supply or raw steel.

VERY HEAVY CALL ON HIGH SPEED GOODS

Toronto Dealers Say That Run During Past Weeks Has Touched the High Mark

TORONTO.—The hot weather seems to make no difference on the volume of business that continues to pass through the houses dealing in machine tools, equipment and supplies. Large plants that have been getting ready for new contracts are receiving generous deliveries of machinery, and in some cases it is expected that the first operations will be under way in a few weeks.

Jobbers are handling greater volumes of trade than has passed their way for some time. They find deliveries much more prompt than they have been for some time. Prices have remained for the most part the same as quoted last week.

The copper situation, while based on the higher price level, has few features locally, although it is attracting no small amount of attention in other sections.

The Steel Situation

Canada is handling a large amount of steel now. Our own men in many places are being trained to steel mill operations. A few years ago there were few furnace or roller men in Ontario, but their number is rapidly increasing. Steel men find that the Canadian, when trained, makes a good steel mill man, and can hold his own in any effort made to speed up production.

There is quite a problem facing the iron and steel men of the Dominion at present, in trying to keep a nicely adjusted balance between the amount of material going out as pig iron and passing over to the open hearth furnaces for further finishing in the plants. There might be an easy tendency on the part of the mills to put through a larger amount than usual for the steel trade, for there is an enormous demand just now for plate, sheet, etc. However, there is a nice balance that must be kept adjusted between pig iron and steel, for in so many cases the machine shop and foundry are to all intents and purposes part of the same institution as far as the finished product is concerned. As one steel man remarked to CANADIAN MACHINERY a few days ago, "What would be the use of going ahead and filling up our steel plant and shutting off the foundrymen? Such a course might give us a slice of good paying business for a time, but it would be mighty poor business in the end for steel men to try and disturb the balance between foundries and machine shops."

As a matter of fact there are not many foundries on essential work that are pinched for pig. Against this there are lines that are not being well supplied, but in many cases they are not in the war group.

Scrap Is Scarcer

The scrap metal trade is not brisk. Buyers are anxious to get material to sell quickly, but that is the kind where there is the greatest shortage. Heavy melting steel and good machinery scrap are much desired just now. At U. S. points the shortage is quite marked, and firms are willing to bring the stuff a considerable distance, paying the excess freight charges in order to secure the metal. Many sales for the more desirable sorts are made at a maximum price with the allowance of 3½ per cent. for brokerage added to that.

One local dealer who was in Buffalo during the week reports that the yards there are making a strong bid for available scrap, as the mills in that district are urgent for a supply of second-hand material.

The Copper Price

While the local quotations on copper remain unchanged this week, there are signs that the price problem has not yet been finally adjusted, and changes later on may have a distinct bearing on the situation. On May 23rd when the price was fixed at 23.50c, it did not meet the approval of the producers, and they did not agree to the price or date. The sales made after May 23rd by producers were generally drawn, not at a definite price, but at Government price ruling at time of the delivery for which the copper was sold. As the War Industries Board gave out that the price was fixed at 23.50c until August 15th, and as the president approved same, consumers accepted contracts for July and delivery before August 15th, worded at the Government price at time of delivery, having the positive official statement that price up to that date was 23.50c, and sold their manufactured goods against their copper purchase on this basis. Now they find they have to pay 26.00c or 2½c per pound higher on their undelivered contracts.

Machinery Trade

Several large deliveries were completed this week, the equipment being for plants that are now ready to begin work on their new orders. Some of the contractors complain of annoying delays, but these are due to some sub-contractor falling down on delivery of a minor part.

The demand for high speed steel has never been at a much higher level than it is right now. Some local dealers state that the past week's business on cutters alone has been away beyond the average. Munitions shops make heavy demands on high speed goods.

There was a rumor in some of the places of business to-day that there would soon be an advance in carbon goods. This is referred to Canadian firms, but so far no new list showing a recent increase has arrived from leading Canadian makers.

LARGE ORDERS FOR MACHINE TOOLS

Figures Are Still Spoken of in Millions in Regard to the Purchases

Special to CANADIAN MACHINERY.

NEW YORK, July 24.—Large supplementary contracts for guns, shells, aircraft and airplane motors are on the point of being placed by the Government; in fact, several substantial orders were released in the last week and manufacturers who have called for prices on large lots of tools for shop equipment are only awaiting Government approval to close contracts for the machinery. The demand for heavy tools used by shipyards and ordnance makers is very active and there is a fair inquiry for small and medium sized tools. Some of the manufacturers of large tools have already begun plant extensions to keep pace with the requirements of the Government.

Government approval having been received by the Wright-Martin Aircraft Corporation for its programme to largely increase output of Hispano-Suiza motors, orders for 600 machine tools to be installed at the Long Island City plant have been distributed; 40 motors a day will be constructed at Long Island and production at the New Brunswick, N.J., plant will be increased from 500 to 750 motors every month. In addition, parts of motors will be manufactured at the Plainfield, N.J., factory, previously owned by the Bosch Magneto Co., which was recently acquired by the Wright-Martin interests from the Alien Property Custodian. The Willys-Overland Co., Elmyra, N.Y., has received an additional contract for Liberty airplane motors which it will manufacture at its Willys-Morrow plant. The Standard Aircraft Corporation, Elizabeth, N.J., having large Government contracts, is about to increase the size of its factory.

Another Government contract for heavy type of Browning guns has been awarded to the Marlin-Rockwell Corporation, New Haven, Conn., and other New England gun makers have put out large lists of tools to increase plant capacity in anticipation of Government orders. The Taylor-Wharton Iron & Steel Co. is buying additional machinery for its Tioga gun plant at Philadelphia. The new shell plant at Chicago belonging to the Symington-Chicago Corporation, is already under construction and an order for about 500 tons of steel has been placed for additional buildings. The Studebaker Corporation of South Bend, Ind., which already has received Government war munition orders ranging from $20,000,000 to $50,000,000, is building a new shell plant to cost $300,000, having been assured of all the shell orders it can handle for the next two years, according to reports in the trade. The Wisconsin Gun Co., Milwaukee, which is now making 3-inch field pieces for the Government, has placed a large order for tools which will double its ordnance capacity.

A shell maker in the Central West has placed an order for 150 single-purpose lathes with a Cincinnati tool builder. The New York trade has received two inquiries for shell-making tools from South America. The John Thompson Press Co., New York, and the New Departure Co., Bristol, Conn., that are making war munitions, have purchased additional shop equipment.

Builders of tractors and gas engines have been buying machine tools in the Chicago market, including the Interstate Motor Co., Muncie, Ind., the Falls Motor Corporation, Sheboygan Falls, Wisconsin, and the J. I. Case Co. Threshing Machine Co., Racine Wisconsin.

Railroads are releasing some orders, the Chesapeake & Ohio having purchased large too's in the East and the New York Central having made purchases in Chicago. The Pennsylvania Railroad is also buying equipment for its Altoona and Marietta, Pa., shops, and fifteen other railroads are actively in the market for machine tools which will cost $5,000,000 in the aggregate.

Two ship berths with auxiliary shops and erecting buildings will be constructed at the Brooklyn Navy Yards by the Bureau of Yards and Docks; 40,000-ton battleships will be built on these ways.

D. H. MacDOUGAL BECOMES HEAD OF THE NOVA SCOTIA STEEL AND COAL CO.

Announcement is made by the officials of the Nova Scotia Steel & Coal Co. that D. H. McDougall has taken the position of president of that company. Mr. McDougall has for some time been the general manager of the Dominion Steel Corporation. Although none of the officials interviewed would admit it, the new appointment may be the outcome of the failure of negotiations which were pending some time ago for amalgamation between these two large concerns.

It is understood that F. H. Crockard, who was brought to Canada from the Southern States to take charge of the Nova Scotia Steel business had been quite anxious to see the amalgamation brought about and that the failure of this was primarily the cause of his leaving the Scotia company. The announcement of the dropping of these negotiations was made in these columns some weeks ago. Mr. Crockard had had a long experience in the steel business of the United States and was reputed to have been about the highest paid official of that industry in Canada, receiving, it is reported, a salary equal to $100,000 per year, together with certain bonuses on production.

Some surprise will be occasioned by the announcement that Mr. McDougall has been appointed president of the Nova Scotia Steel & Coal Co. as the Dominion Co. with which he has been associated for some time has very large and important undertakings at the present time, many of them being based on war contracts which that company has taken on from the Dominion Government. Mr. McDougall is essentially a Canadian in every sense of the word, in his training, and in his practice, and in his knowledge of mining conditions, in the eastern part of the Dominion. His training includes a first hand knowledge of the iron ores of Newfoundland, of coaling conditions, and of steel manufacture, as well as an engineering experience of a very wide and varied character. His training has been of such a character that it would give him a first hand knowledge of every detail in connection with the steel business and enable him to appreciate the problems of every department from the office work through the mill and down to the men doing the most menial sort of work around the plant, as he has been taught to work with his hands as well as his head. There are few men in the East who have been more successful in dealing with the varied complex and difficult labor problems that have been arising from time to time than Mr. McDougall. For some years past he has had to face the peculiar conditions of producing more steel than ever before and having fewer men to produce it with.

It was in 1909 that Mr. McDougall first received his appointment as assistant general manager of the Dominion Coal Co. and at that time the labor conditions in connection with the plant were not in a very happy frame as a strike of the workmen had been in progress there for some time. A year later he was successful in closing the protractive stoppage of work at the Spring Hill mines. During the time that Mr. McDougall has been in charge of the management of the Dominion Coal Co. at Glace Bay he has succeeded in raising the production figures of that corporation from 3½ to 5 million tons. Under his direction new coal mines were opened up and as quickly as this was done they were equipped with the most modern machinery. Central power stations were conceived and instaalled and other operations co-ordinated in such a way as to produce the result indicated above. It is also stated that the plans on which Mr. McDougall had been working at Sydney, were such that the production of steel ingots there would have been placed at a figure equal to 35,000 tons per month inside of a few months. Coke ovens of the very latest type and a modern blast furnace are included in the equipment with which he expected to produce the results. The construction of the new plate mill on which a great deal of Government work was to have been done also came very closely under Mr. McDougall's connection, and it is likely that he will have the satisfaction of seeing this work well under way before he leaves that company. So far no announcement has been made by the Dominion Steel Corporation regarding a successor to Mr. McDougall as the general manager of that corporation.

PLATE MIILS ARE THE HOGS OF RAW STEEL AND OTHER INDUSTRIES SUFFER

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., July 24.—It is claimed the interesting discovery has been made that some Canadian steel has been sold in New England at prices far above the Government limits, and for non-essential purposes, while steel made in the United States has been sold in large quantities to Canada at the set limits. It is stated the subject will be taken up with the British Mission.

The rate of steel production was discussed in last report, with particular reference to the rate in June as indicated by the monthly report of the American Iron and Steel Institute. Since then a new complexion has been given the situation by Institute announcing that one of its members understated its June output by 46,516 tons. This means that the rate of steel ingot production in June was at the rate of about 43,500,000 gross tons a year instead of the rate of 42,860,000 tons indicated by the original report. While the change is apparently a slight one, it makes it that June was the best month of the quarter instead of the poorest, also that since the very low production rate of last January there has been a successive improvement each month. Thus there is much better ground for hoping that further increases in the rate will occur later in the year. July and August may show declines, on account of hot weather, but thus far in July the weather has been normally favorable for the season.

Want Old Material

That the full output indicated by the rated capacity of not less than 47,000,000 tons can be attained is, however, quite improbable, by reason of the shortage of scrap and the poor quality of the supplies available, as noted in last report. There are, of course, no prospects of improvement in the scrap supply. The country is being combed for old material but at best such material would be of poor quality. The difficulty arises largely from the nature of industrial operations now being carried on. The railroads are wrecking few cars and locomotives and abandoning smaller quantities of old rails than usual, while there is very little tearing down of old bridges and buildings. Furthermore, there is reason to estimate that more unfinished steel than usual is leaving the country, the scrap arising from the finishing operations being produced abroad instead of at home, and there are practically no importations of scrap. Thus the industry will probably have to peg along at a rate of production under what would occur if conditions as to operations were normal. A slight improvement in steel production may occur if pig iron production increases, though as a rule the steel works want more and better scrap rather than more pig iron.

War Requirements

The rate of production is, however, distinctly better than the rate in 1917 or 1916 because while the output is lower in proportion to capacity there have been material increases in capacity. The rate of steel ingot output of 43.500.000 gross tons a year means an output of finished rolled steel of nearly if not quite 36,000,000 net tons a year, or about 3,000,000 tons a month. In a fresh statement as to steel requirements and supplies the WarIndustriesBoard has now put the war programme as requiring 20,000.000 net tons or perhaps 21,000,000 net tons, during the second half of this year, while it points out that the industry has never produced more than 16,500,000 net tons in a half year. There is, however. considerable basis for hoping that 18,000,000 tons can be produced, possibly more. Steel producers as a class remain chary of accepting the War Industries Board's statement of requirements at face value, having doubts whether the various war activities that call upon the Director of Steel Supply for their various tonnages will really be able to consume the full tonnages within the period set. No one questions that there are precisely formulated requirements totalling 20,000,000 tons the point being how soon the tonnage can actually be fabricated or otherwise utilized.

Plates are being produced at the rate of 500,000 net tons a month, and the major portion of the tonnage is going to the shipbuilding industry, but there is a moderate tonnage of Bessemer steel plates going into carbuilding and other items of essential nature but not absolutely requiring open-hearth stock. Production of shell steel may be estimated at not much under 500,000 tons a month, so that about one-third the total finished rolled steel output is going into these two items. Tin plate, formerly a very small item in point of tonnage, accounts now for more than 150,000 net tons a month. The structural mills are operating very nearly at capacity, with the heavy demand for shapes for shipbuilding and for various large construction jobs of the army, and are perhaps turning out a larger tonnage than ever before.

Where Steel Is Scarce

On account of the erection of so many new plate mills, and for the pushing of all plate mill capacity to the limit, the plate mills are drawing an altogether unprecedented proportion of the total supply of raw steel. The shell steel is alfrom the usual finishing channels, while the tin plate branch is taking more steel than ever and possibly also the structural mills.

With these heavy drains it is readily seen how the other finishing departments, the rod and wire mills, the sheet mills, the merchant pipe mills and the merchant bar mills, are not getting anything like their normal tonnage of crude steel to finish. It is reported that the wire rod mills are restricted to 60 per cent. of their normal full supply. The sheet mills, which the Director of Steel Supply only a few weeks ago desired to be limited to a 75 per cent. operation, are now lined up by a new system of distributing steel to them, to an operation of about 60 per cent. Some merchant bar mills are almost idle, others running only fairly well, depending on the sizes and shapes they are fitted to make.

Thus steel in various finished forms that are not required in particularly large quantities for the direct war work are made very scarce nevertheless, and there is no finished form which is plentiful or even in fair supply.

The total demand for steel that is given no priority or preference, the so-called "unessential" steel, is not estimated at more than 10 per cent. of the total at the outside. If steel were available for this demand it would be steel called Class D, left after the priorities and preferences are taken care of, but there is no such steel, to speak of, and it could not indeed be rolled under the regulations, which require a permit (Class D steel is subject to permit, except fiveton lots) not simply for the shipment of the material but also for the production. If a mill had a surplus of raw steel it would have to hold the steel in ingot form. The War Industries Board has even announced that shell steel discards may not be shipped without permit, though it intimates that the permits may be granted with some freedom.

LIFE IDEALS—The life ideals of a modern educated person cannot be acquired from books or sermons, but must be rediscovered or at least reconstructed by himself, and tested in his experience. The process of acquiring true "weatherproof" ideals involves hard work, devotion, and close attention, like any other human activity.—V. Karapetoff.

THE INDUSTRIAL DEVELOPMENT OF CHATHAM HAS BEEN QUITE MARKED

Although the manufacturers of Chatham, Ont., have not derived much benefit from the large orders for shells that have been, and are still being placed, in the Province of Ontario, the industrial development in the district has been considerable. Only one firm, the Hays Wheel Co., is engaged upon munitions, producing approximately 400 six-inch shells per day. The development in Chatham has been of a general character, incidentally reflecting the favorable situation of this city as an industrial centre. The character of the development and nature of the industries, foreshadows a continuance of prosperity after the war and comparatively little readjustment, as the general line of product manufactured may be said to be of the peace time variety. In other words, the manufacturers will continue in the same line of production after the war as now. By reason of its geographical location, Chatham is favorably situated as an industrial centre. Being only a short distance from Detroit, has been an attraction for American capital, a factor which has been largely instrumental in the development of many Canadian border cities. Chatham is also the centre of a large and prosperous agricultural district; the advantages of this may be seen in the growth of certain industries, particularly the Gray-Campbell Co. carriage works, who make a fine line of buggies, etc., and the Dominion Sugar Co. The last mentioned concern has built a large modern factory costing $1,200,000 for making beet sugar, the beets of course being grown in the vicinity. The well known Chicago firm, the Libby, McNeil & Libby Co., has recently established a large and modern factory in Chatham for manufacturing pickles from vegetables grown in the surrounding district.

Another American concern, the Canadian Des Moines Steel Co., has a plant here for making steel tanks and similar products. The Gray-Dort automobile is made in Chatham and in this connection it is interesting to note that practically all the parts of this car, with the exception of the motor, are made in Canada. At one time, and not very long ago, practically all the parts in the majority of Canadian-built cars were imported from the United States and assembled at the Canadian factory. The Gray-Dort Motors, Ltd., which is operated under the management of Robert and W. M. Gray of Chatham, has extended its activities recently by taking over a factory formerly owned by the Blondy Mfg. Co. for building car bodies.

The output of Gray-Dort cars has been, so far this year, considerably greater than was estimated, a further impetus to Chatham's industrial activity. It is not unlikely that the company's No. 1 plant on Colborne street will have to be extended to take care of the increasing demand for its product.

Among the older concerns connected with the engineering industry in Chatham may be mentioned the Dowsley Spring & Axle Co., Park Bros., McKeough & Trotter, and the Chatham Malleable & Steel Co. The International Harvester Co. have completed the construction of a foundry and other buildings at their plant here.

Natural gas from the Tilbury fields has been an important factor in the development of Chatham as a manufacturing city. Gas is largely used at the local factories for generating steam and also for lighting purposes. The Chatham Electric Co. uses natural gas entirely, generating about 1,600 h.p. by means of gas engines and also using gas under the boilers for its steam plant. Hydro power is installed in Chatham, which is an additional advantage for manufacturers as well as for the citizens as a whole. Cheap power and two railway systems are thus available for manufacturers, both important considerations in the growth of a manufacturing centre. The steady growth of Chatham is reflected in the building construction going on in the city and the increase in building permits.

Gas engines of the four-cylinder double-acting type working on the four-stroke cycle have been made in units up to 4,000 horse-power, and engines on the two-stroke cycle have also been constructed in large numbers and high powers, and have given a satisfactory performance up to 5,000 horse-power. It is estimated that to-day the gas engines at work represented 4,000,000 shaft horsepower. The Diesel engine of the horizontal type, made double-acting with two cranks, a pair of cylinders being arranged tandem on each crank, has been constructed in units up to 4,000 horse-power, and vertical engines single-acting and working on a two-stroke cycle up to 2,500 horse-power. This latter type is that generally preferred in marine work, but for submarines six-cylinder engines of 1,000 horse-power, with a four-stroke cycle and 2,000 horse-power engines with a two-stroke cycle have been used. The fuel consumption of the Diesel engine, assuming fuel oil to have a thermal value of 18,000 B.Th.Us. per lb. works out at .47 lb. per shaft horse-power per hour, giving an efficiency of about 30 per cent. as compared with that of a steam engine equipment, in which the coal consumption was 1.5 lb. per indicated horsepower per hour, which was 10 per cent.

Current Events in Photograph

SCREENING THE SEADOGS

Nowhere has the art of camouflage been more successfully used than in the spectacular attack on the U-Boat bases of Zeebrugge and Ostend. Under a screen of smoke the ships of the fleet were enabled to get close enough to bottle up the U-Boats. This photograph was taken on board the Iris, one of the covering ships used in the Zeebrugge raid. One of the officers is turning on the tap to release the smoke that made a screen like a mist between the attacking ships of the fleet and the land batteries.

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Promotion the Real Way to Keep Employees

The Employment Department of Any Organization Should Seek to Pass on Only the Most Suitable Applicants to Departments Where Openings May Have Occurred—How the Work Can be Co-ordinated

By M. H. POTTER

THE raising of the standard of efficiency of the working force, individually and as a whole, in order that the purchasing power of the wage-dollar may be increased, is the broad function of the employment department. The employment department is the department whose duty it is to develop the efficiency of the workers, directly or indirectly, and to bring about a condition in which the individual employee will render as nearly as possible 100 per cent. to his employer.

Personal efficiency is composed of various proportions of brains, health, instruction, loyalty, enthusiasm, ambition, ability to co-operate, personality and character. This purpose can best be served through a centralized employment department, under a manager reporting directly to the general manager of the company—a department composed of four divisions, as follows: first, the employment division, which assumes the task of selecting and engaging the help; second, the medical division, whose function, of course, is to see to the physical health of the employees; third, the instruction division, through which the employees are given the opportunity to increase their special ability and training; fourth, the welfare division, whose purpose is to create a favorable mental background for the workers. Let us consider these divisions in order.

Employment Division

It is the duty of the manager of the employment division to keep in touch with the sources of labor supply and engage workers best qualified to fill the vacancies occuring in the organization. These vacancies are reported to it on labor requisitions received from the executives of the operating departments. When a mechanical engineer constructs a machine, he naturally exercises the greatest care as to the quality of the material he puts into it. Similarly, when a human engineer is constantly at work building up an efficient working force, he must use the best care and discrimination in choosing the units which are to comprise it. Subsequent training is indispensable and frequently is instrumental in transforming unpromising employees into efficient workers; but the value of the training is greatly increased when it is applied to responsive material and the result is much better.

The employment office file in which are classified by kinds of work the application blank filled out by individuals who have called seeking employment, is the most fruitful source of supply. Quite naturally, for every position that is open there are several applicants. Only one can be selected for the particular vacancy, but among the others are invariably several who are well qualified for consideration when other vacancies occur.

Another source of supply is that represented by the payroll. Whenever a position of any importance is to be filled, by going through the present organization there will be found persons who can be promoted to that position.

Of course, splendid material for stenographic and clerical work can usually be obtained from the high schools, the principals of which are naturally interested in placing their graduates. Similar material of a clerical nature can often be obtained from the various typewriting agencies who, in a similar way, are interested in placing their clients.

As a rule there are several employment bureaus of the city always at service, but owing to the nature of their clientele, much undesirable material passes through their doors. Too many bureaus of this kind operate in a mechanical way, without giving the vocational guidance to which applicants are entitled. Too frequently they feel their duty is done when they give an applicant a letter of introduction to an employer regardless of whether or not he is particularly equipped for the employer's service or whether he is accepted.

A vast quantity of material is available through the classified advertising columns of the newspapers. Advertising of this kind naturally brings a certain proportion of applicants who are hopelessly unfit, but these can be rapidly eliminated and desirable applicants retained for more complete analysis and examination. Except where immediate action is needed, the blind advertisement is more satisfactory than the advertisement which mentions the employer's name. Blind advertisements automatically eliminates much of the hopeless material and enable the manager of the employment division to exercise preliminary judgment by analyzing the letters received from the applicants.

Applicants for positions are shown into an anteroom, where those who are obviously undesirable are weeded out. Those who deserve further consideration are requested to fill out application blanks which, when complete, show their age, their previous business experience, the names of their previous employers, the length of their service and their reasons for leaving those employers, their previous salary and the salary expected, and the names of references. Each of these blanks is delivered to the manager of the employment division, who thus has a chance to analyze each applicant's previous experience before the applicant himself is shown into the managers 'inner office.

Doubtless each employment manager has his own particular system of sizing up applicants. Immediately after the interview or during it, the manager of the employment division fills out one of our analysis cards with which it is possible to mentally reconstruct the applicant at any future time, in order to consider him for any later vacancy, if he is not employed immediately. The analysis cards contain eight divisions, as follows:

Personality.
Build.

English.
Type of mind.
Executive.
Detail.
Promotive.
Mechanical.
Analytical.
Appearance.
Mentality.
Super alert.
Alert.
Average.
Slow.
Dull.
Initiative.
Remarks.

The phrases explain themselves. Let us assume that a certain applicant has called at the employment office, has filled out an application blank, has been interviewed by the manager of the employment division, and has passed satisfactorily. The applicant is then conducted to the executive of the operating department for whom he has been secured, and is interviewed by that executive, whose decision is final. If the applicant similarly satisfies the operating executive, he is then sent back to the employment division and examined by the physician in the medical division. If the physican gives him a clean bill of health, the employee s then told where and when to report by the employment division, is given final instructions, and is made to feel as much at home as possible.

Letters of inquiry are then sent to the persons named as references by the applicant. The value of these references is moral rather than practical, as few employers will voluntarily stand in the way of an ex-employe of theirs securing employment elsewhere.

If the applicant should be rejected by the executive in the operating department, he is similarly sent back to the employment division, where he is either placed elsewhere in the organization or told that his aplication will be considered snould any other vacancies arise for which he is qualified. Occasionally the judgment of the manager of the employment division and the operating executive will differ in this way; yet the employment department never makes an issue of such a case or endeavors to force an employee upon an unwilling executive. Such an issue would not only be bound to arouse antagonism on the part of the operating executive, which in turn would be fatal to harmonious and efficient work on the part of the employment department, but it would also fail of its purpose, inasmuch as whether or not the operating executive has the legislative activity to reject an applicant recommended by the employment department, he at least has the ability to make things so unpleasant for the new employee that he would willingly resign.

However, the engaging of help is not the complete function of the employment department. This division similarly acts as a clearing-house of labor between department and department and makes possible a condition in which one department may be laying off help while another department of the same company is engaging help of the same character. It is obligatory upon the employment division also to keep as accurate a report as possible of the performance of employers and to transfer those who are misplaced to other positions for which they are better fitted by temperament. An employee who works at his job because he is fitted for it, because he enjoys it, and therefore, puts enthusiasm into his work, is worth far more to his employer than the worker who works indifferently at his job only because he is paid for it and who quits as on principle immediately on the stroke of the bell.

Medical Division

The work of this division dovetails somewhat with the work of the employment division. The hospital consists of a waiting room, an outer office, where bandages are applied and minor injuries treated by the orderlies, and the inner office, where the doctor holds his examinations. An orderly is in attendance both day and night and a physician is in attendance every afternoon. Two nurses are constantly in attendance at the women's hospital during the day and night.

Instruction Division

Three good-sized rooms, well-lighted, comprise the quarters of the instruction division. Instruction is the process of training a new employee capable of delivering perhaps 10 per cent. service into a trained worker capable of delivering 90 per cent. service or better. Methods of this training differ with different concerns. Some concerns, owing to the nature of their work, find it best to maintain schools, under salaried teachers, for this purpose. Other concerns have their instruction work done departmentally by persons designated to that task or even by foremen and fellow employees. Where the instruction work is done in this way, the employment department should be an interested party. It should either exercise direct control or a strong advisory influence.

Welfare Division

The work of this division has direct reference to the state of mind of the employee. This division of the work is founded on the certainty that an employe who is happy and satisfied and free from anxiety and who works under favorable physical conditions will do better work and more of it than an employe who is dissatisfied, fearful of the future, and who does his work in an unfavorable physical environment. For want of a better name, this division of the work is called "welfare work."

Industry is coming to regard personnel as one of the big factors to be considered in every undertaking, and if it is so, then the work of the welfare department is an economic necessity. But this work must be conducted along economic lines, as every other department is conducted, every dollar spent on it must yield 100 cents in return.

It is the duty of the welfare division to go after the fundamental things first. The question of wages and hours of labor are, of course, such broad subjects that all the administrative officials of the company collaborate on them. The welfare division, however, gives constant attention to matters of almost equal significance, the conditions under which the employes work—light, air, safety devices, sanitary arrangements. It is not reasonable to expect an employe to reach his or her place of work in the willingnes, if he has to pass through the garnut of dark, congested coat rooms and either climb several flights of stairs or wait his turn to get into an elevator together with a crowd of other workers, al as vexed as he. To bring the individual employe to the frame of mind where he is able to deliver efficient services, it is obvious that the employer, through the welfare division, should arrange for those physical surroundings which will breed self-respect, cheerfulness and confidence.

Restaurants are maintained, where the employes can secure their meals at minimum rates without going outside. Restaurants of this kind are largely self-supporting. Good food makes for good health, especially when served under agreeable conditions, and the lunch hour is the time when the employes meet socially.

In addition a recreation room where those who wish to talk and engage in more active persuits are permitted to make as much noise as they wish. It has been found that rest rooms, smoking rooms and recreation rooms justify their expense many times over bby keeping the employes in the building during the noon hour.

In General

By the very nature of its field, the employment department must be a service department. It is not an operating department, but it should work hand-in-glove with the genuinely sincere way to increase their own efficiency, through increasing the efficiency of their employes. It should not seek credit for what it does, only results—onwhich in the end is must stand or fall. Many of its achievements for the improvement of the working force must beb accomplished indirectly, by counsel and advice, and the credit oftentimes must go elsewhere. If by its activity, either direct or indirect, there results permanent economic advantage to the company through the improvement of its human relations, the employment department will take its place in the organization as one of the productive departments.

The Plan of Promotion

An adequate system of promotion is the solution not only of holding employes in an organization, but also of the employment problem.

There is to-day much emphasis upon the proper selection of employees, and many and elaborate systems have been undertaken for a scientific placement. These are not in army wise to be criticized, for the selection of the indivii-duals comprising any organization is important, and any plan that will cause the employment manager to plan his duties carefully and to give each decision on the fortunes of others careful consideration is to be commended. It must beb realized, however, that even more important is holding and helping these employees after they have been selected, and providing an adequate systematized plan of advancement for them. It has been so figured in some plants that efficient placement becomes almost automatic, and a supply of desirable applicants for any position is constantly available. The following three points are important:

1. The necessity of attracting desirable applicants.
2. The necessity of holding, fitting and promoting those already employed.
3. The interdependence of these two.

This plan of promotion considers each employee as occupying three positions in the organization, and considers these three positions as constantly changing in an upward spiral, as the man is promoted from the lowest position that he occupies. The three positions are as follows: first, and lowest, the position that the man has last occupied in the organization; second, the position that the man is occupying at present in the organization; third, and highest, the position that the man will next ocupy. In the first position the worker ocupies the place of the teacher, this position being at the time occupied by two other men, that is, by the worker doing the work, who receives little or no instruction in the duties of that position except in an emergency, and by the worker below who is learning the work. In the second position the worker is actually in charge of the work, and is constantly also the teacher of the man next below him, who will next occupy the position. He is also, in emergencies, a learner of the duties of his present position from the man above him. In the third position the worker occupies the place of the learner, and is being constantly instructed by the man in the duties of the position immediately above.

Naturally a plan like this demands a close co-ordination of all positions. This is provided for through the master promotion chart. This chart is in the hands of the man in charge of promotion. It consists of a schematic arrangement of all positions in the organization, so arranged as to provide for lines of most rapid advancement, along the various functions and subfunctions, under which the measured functional management by which it works. The great advantage of such a chart is that it makes possible visualizing the complete problem of the organization's needs in teaching and preparing its members. The direct product of this is that the man in charge of promotion sees clearly the needs and the means of filling them, the demand and the supply. The important by-product is the gradual evolution of permanent, rapid, direct paths of promotion. Another by-product of this chart is the fact that the promotion head, the promotion manager, or chief of promotion, as he has been variously called, can arrange for shifting or transferring the worker easily, if he sees that he has been improperly placed, or, if he develops abilities along some unexpected line. This is often the case under this type of management where there is great opportunity for the development of talent, as well as apparent, abilities.

Upon the promotion charts the records of each and every member of the organization are separately kept. When a worker becomes a member of the organization he is called into the department in charge of advancement or promotion, and given one of these charts. Upon it is shown his present position, and he and the man in charge outline together his possible and probable line of advancement. The projected line of promotion is outlined in green, and upon it are placed the dates at which it is hoped he may reach the various stages of advancement. At set times the worker and the promotion chief, or one of his helpers, meet, and the line of actual progress of advancement of the worker is traced upon the map in red, with the dates achieving the various positions. The two then consult as to existing conditions, the special reading and studying necessary for fitting for the new positions, possible changes, or betterments.

The ultimate success of this plan depends upon the principles that underly it, giving every man a square deal, a maximum chance for cooperation, advancement and prosperity, in other words, the opportunity for simultaneous individual and social development.

ROMANCE OF GAS BY-PRODUCTS

By I. T. H.

There is nothing more remarkable in the fairy tales of industry than the manner in which the Cinderellas have been taken from the kitchen, so to speak, and given precedence over their step sisters. In soap-making, for instance, at one time the soap was the only thing that mattered and the glycerine which was produced at the same time from the fats and oils was run down the drain. Now the soap works are busy night and day primarily making glycerine for munitions, and the soap is almost a waste product. It has been very similar in gas making. At one time the gas liquor with its evil smell was merely a nuisance, now nearly all our ammonia for fertilizing the fields, a large part of our sulphur, and the cyanides for the extraction of gold are obtained from it. Not long ago the recovery of tar from the bottoms of pits and canals, where it had been run to get rid of, was quite a business, but tar now gives us the bases of our aniline colors, many of our most valuable medicines, and even perfume; while the tar oil becomes at the touch of the chemist's wand, lyddite, trinitro-toluol, and similar substances for the terrible high explosives for our shells, mines, and torpedoes. So valuable have the benzol and toluol become that the tar, however carefully it be treated, does not supply enough, and processes have been at work for some time to recover the comparatively small quantities that exist in coal gas itself. So far these methods have been only partially successful. According to a new process, it will be possible to secure about two gallons of benzol and a tenth of that quantity of toluol from every 1,000 cubic feet of gas. The method is simplicity itself. The gas passes through a tower filled with lumps of porous material saturated with oil, which absorbs the whole of the benzol and toluol, and then by the simple application of steam separates them; they float on the top of the condensed water, and can be drawn off ready for use, requiring only to be separated from one another by distillation. The discovery will add very greatly to our resources not only for making high explosives during the war, but also for our rapidly growing aniline dye industry in both war and peace; and later, when our big guns are at rest, it will provide a source of fuel for our motor vehicles.

The exportation of refrigerated beef is one of the important features of the Brazilian export trade during the past few years. From 1914, the first year of the war, the exports have increased from 1 ton to 66,452 tons in 1917. Brazil is unquestionably destined to become one of the great meat-producing countries of the world, and not only do its present exports bear out this fact, but the establishment of large packing plants, many of the mbeing financed by large American firms, shows clearly that the future prospects of the country as a producer of fresh meat are very promising. More than 50,000 tons, or nearly 80 per cent. of the total of refrigerated beef, went to Italy; Egypt took nearly 6,000 tons, France over 5,000 tons, and Great Britain nearly 4,000.

Gage glasses are very susceptible to surface abrasions, even so minute as to be unobservable. If one receives the slightest scratch inside or out, it should not be used, and in handling or keeping them in stock, no metal of any nature should be allowed to come in contact with them. They are particularly liable to break if iron or steel touches them and should never be laid even temporarily with tools, as is frequently done.

Making Shrapnel and High Explosive Shell Bars

Weight and Balance of a Shell Made From Solid Bar Steadier Than That of a Cast Shell in Flight Through the Air

By W. S. Standiford

IMMENSE quantities of shrapnel and high-explosive shells have been made in U.S. for the Allies and since the United States has joined in the conflict considerable amounts of munitions are required by the American Forces; as steel bars are the basis from which the shells are manufactured, the design of the rolls, their proper adjustment and handling should be subjects of much interest.

At first thought one might suggest that the shells be manufactured faster and better from castings containing the chamber for powder and bullets, thus leaving very little metal to remove in the machining processes, as contrasted to the existing practice of punching a hole in a solid steel blank and then finishing the interior and exterior. But castings cannot be used in this case for cast metal usually contains airholes, making it dangerous material for shells; were cast shells used, there would be danger of their bursting in the guns.

Another reason is, that the weight and balance of a shell made from a solid bar has a steadier flight through the air than one made from a casting, since in the latter, the heavier ingredients of the steel settle to the bottom during the cooling, making certain parts of the walls heavier than others, which obviously disturbs its balance during flight. Steel bars as munition material have the carbon and other ingredients equally distributed, for the rolling process mixes them equally, making the metal fibrous in character.

The size of the round bar is 3½ inches in diameter; this is the size used to make the 18 pound projectile used in British field guns, and it will be noted that sufficient metal is allowed on the above sized bar to permit of the machining operations. In the first illustration, are represented the roughing rolls, the latter being three-high; which design rapidly reduces the steel as compared with the two-high ones; quick reduction of the hot bars at the start is most important, for the metal must be worked while it is at a high heat, this makes it fibrous, which is a desirable quality, since this condition makes for strength in iron and steel; the roughing rolls contain two boxes and two edging passes; the others being put in on an angle.

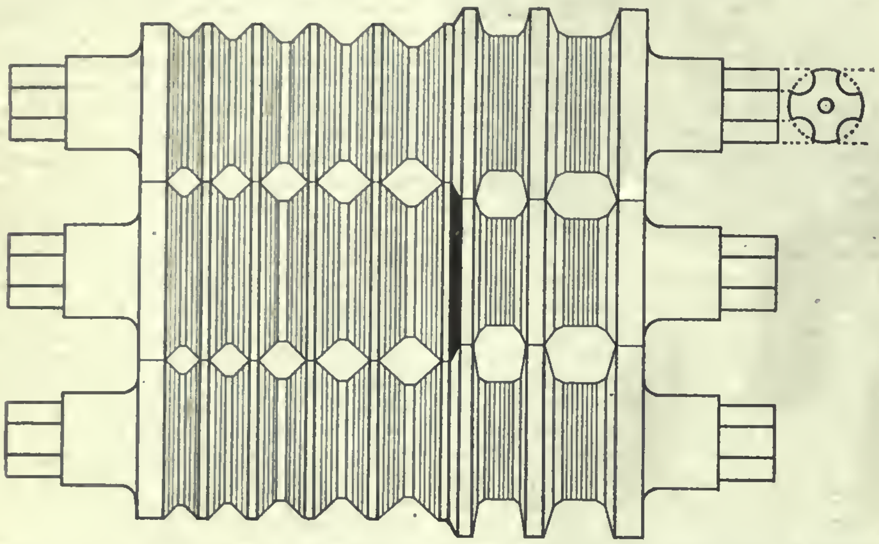


FIG. 1—ILLUSTRATES BOX AND EDGING PASS ROUGHING ROLLS. THE DEEPEST PASS IN THE BOTTOM ROLL BEING WHERE THE STEEL BILLET IS ENTERED FROM THE FURNACE. THIS STYLE OF GROOVE REDUCES THE METAL VERY RAPIDLY, THE VIOLENT CHANGE IN SECTION FROM THE BOX AND EDGING PASSES TO THE SQUARE ONES THE STEEL FIBROUS IN NATURE WHICH IS A HIGHLY DESIRABLE QUALITY IN IRON AND STEEL.

Box and edging passes, by their shape, allow heavy drafts to be used, which is exerted upon the tops and bottoms of the bars, there being no work done on the sides. The heated metal from the furnace goes into the deepest box pass, it is then pushed into the next largest one between the middle and top rolls; being now turned over on its side, it goes through the edging pass in the bottom roll and is repeated through the top edging pass.

The steel in the shape of a long square bar is now ready to be rolled in the angle shaped passes which next engage our attention; these have an angle of 95 deg. and by their position in the rolls, work the bars mostly on the top and bottom corners—the corners at the sides have no work done on them. The bar goes through the angle passes alternately, until it is reduced to four inches in diameter; then it is ready for rolling in the hand rounds or finishing rolls which appear in the second illustration.

Any person looking at a set of hand round rolls in the housings or a drawing of them would wonder how they could make a round bar, as the grooves appear to have an oval shape instead of a circular one, but this is a case where appearances are deceptive; the grooves are put in by means of round steel plugs, which are ground after hardening, as the latter throws them out of true circular form.

Each roll contains one-half of the grooves for making various sized round bars; after the round groove is put in by means of the plug, the sides near the top are cut away at an angle by using another tool, the reason for this being that it prevents a long ridge or fin from forming on each side of the

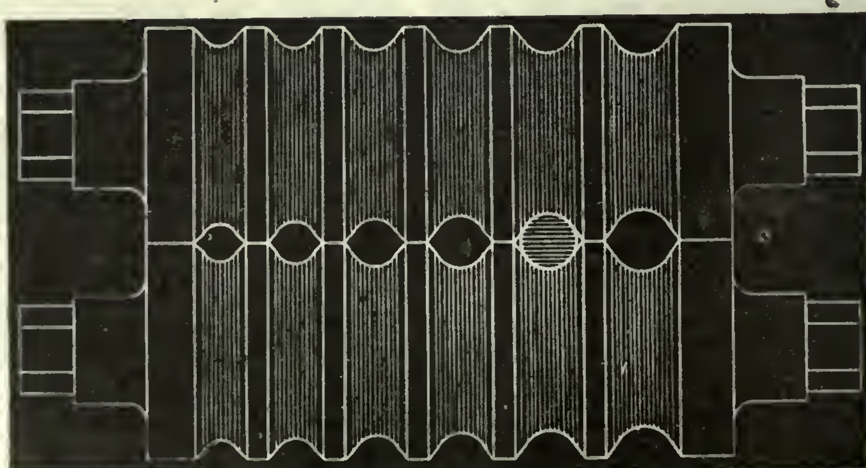


FIG. 2—SHOWS THE APPEARANCE OF THE PASSES IN THE FINISHERS. THESE PASSES IN THE ROLLS APPEAR ANYTHING BUT ROUND, THE CUTAWAY PARTS OF EACH PASS BEING NECESSARY TO LET THE BAR LEAVE ROLLS EASILY WITHOUT TEARING IT AT THE JOINTS OF THE ROLLS. THE SHADED SECTION OF A BAR IN THE FINISHING PASS SHOWS HOW A BAR LOOKS IN THE OVAL-SHAPED PASS.

bar at the joint of the rolls. The following description of the rolling of a bar will show how it is made round instead of oval. The four inch square bar from the roughing rolls is sent once through the 3¾ inch pass, it is then turned over at a right angle to its previous position and is pushed into the 3½ inch finishing pass; as the bar from the 3¾ inch groove goes through the 3½ inch one, the metal spreads out in the extended sides and is about 7/16 of an inch wider at the sides as a result.

The part that touched the top and bottom of the pass being the correct size, it is then again turned over at a right angle so that the wide part will touch the top and bottom of the grooves, and rolled again; the part of the bar rolled to the finished size now faces the cut away portions of the pass, but does not touch it, therefore it keeps the right diameter while the wide part of the bar is being rolled to size. This is followed by again turning it to a right angle to its previous position and giving it its final rolling; the shaded outline of the finished bar indicates that the total width of the cut away clearance part of the pass is slight. In buying steel for shrapnel shells, the requirements of the purchaser are most exacting, with the result that the manufacture of shrapnel and high-explosive bars is costly.

As an example, bars for high-explosive shells call for a discard of 40 per cent. of the ingot; bars for shrapnel, 30 per cent., and ordinary steel bars about 15 per cent. The bars for high-explosives and shrapnel shells are subjected to a rigid inspection, the demand for a large ingot waste by the purchaser is due to the latter's desire to secure a metal free from airholes and segregation, which would interfere with the proper working of the shells in the guns.

THE PRODUCTION OF LIQUID AMMONIA

By Mark Meredith

Until the beginning of the war Holland was dependent for its supply of liquid ammonia upon England, Germany and more particularly Belgium. At the commencement of 1915 no liquid ammonia was to be had in Holland, as not only the ammonia itself, but also the steel cylinders for containing it, had been commandeered in the belligerent countries, or declared contrabrand of war. This caused much trouble to the industries making use of low temperatures. Calculation showed that the total annual consumption of Holland would amount to something like 27,000 kilogrammes.

At the Arnheim gasworks all the ammoniacal liquor produced was generally converted into pure concentrated ammonia solution: but during the war the high prices of sulphate, and the national need for artificial fertilisers, led to part of the ammonia being sent out as sulphate. The ammonia as driven off is saturated with water; but it is important now to obtain it as dry as possible, to ensure the safe working of refrigerating machines. The restrictions in this connection are therefore of increasing severity. Whereas some twenty years ago 0.9 to 1 per cent of water was permitted in liquified ammonia, the maximum now allowed has been lowered to 0.4 to 0.5 per cent. The drying properties of chloride of lime cannot be made use of, as it combines with ammonia. Caustic soda too is valuable in these days, so there remains only as an available drying agent burnt lime. This, however, has insufficient drying effect, except under pressure. With the pressure at normal, the lime generally left 0.9 to 1 per cent of water in the gas. The most effective means of producing totally anhydrous ammonia—with 0.05 per cent of water—is by evaporating the liquified ammonia, and subsequent reliquifying of this volatilised first product.

At the Arnheim works efforts have been made to eliminate the greater part of the water by cooling. To the current of wet ammonia gas, there is added liquified ammonia at a regular temperature. By the evaporation of the liquified gas the temperature falls as low as 15 deg. C. Thus the water is condensed, after which the gas is led through the drying apparatus. The condensed water is of course saturated with ammonia and leaves the compression plant through a syphon. The amount of liquid ammonia, about 7 per cent of the total bulk produced, is naturally not lost, as it is liquified again. It is taken from cylinders and not from the general storage holder, to permit of control of the quantity used. After this treatment the gas passes through two towers filled with lumps of burnt lime; the inlet being at the upper side, the outlet at the under side. Provision is made for subsequent treatment of the gas with caustic soda lumps in a separate tower.

After these processes the gas passes to a large storage holder, from which it goes to compressing plant very similar to that in use for the manufacture of ice, except that there is no brass and the compression cylinder stands in circulating cooling water. Mineral oil is used for lubrication, an oil-separator being placed after the compressor for removing the surplus oil. In spite of this cooling, the ammonia gas when compressed at from 7 to 10 atmospheres becomes warm. It is condensed in a large cooling coil, and then collected in a storage receiver of about 70 gallons capacity, thereafter being emptied from this into the steel bottles.

On the pressure side of the compressor, and above the cooling coil, there is a blow-off tap. The permanent gases, and more especially the air, which accompany the ammoniacal gas from the stills are blown off during the working, and conducted through water for the retention of the ammonia. From the storage receiver the ammonia is charged into steel bottles, after these have all been emptied by a small pump operated by the gas engine which drives the compressor. The chemical and physical properties of gaseous and liquified ammonia are well known; but there is one peculiarity which may be referred to—the high expansion co-efficient of the liquid. At ordinary temperatures this expansion is less marked, but at slightly raised temperatures the increase becomes very marked gramms.

At 10.0° C.	pressure is	88.2 lb.	per sq. in.
" 50.0° C.	" "	294.0 lb.	"
" 65.7° C.	" "	455.7 lb.	"
" 67.7° C.	" "	860.0 lb.	"

Thus, for a rise of temperature of only 2 degrees C., the pressure is almost doubled. The filling of the bottles therefore needs special care, for when the expansion is not taken into account an explosion of the bottle is to be feared. The delivery of high ammonia during the first year amounted to 40,000 kilogrammes.

EASTERN SPRUCE FOR AEROPLANES

So great is the demand for airplane spruce by the Allies that eastern as well as Sitka spruce is now being used. Canada has large resources of eastern spruce, which has hitherto been used mostly for the manufacture of pulp, paper and lumber, and the British War Mission is at present trying to secure in eastern Canada as large an amount as possible of the grades suitable for airplane manufacture.

Eastern spruce has for some time been used for airplane construction in the United States, although only a very small percentage of this timber is sufficiently clear for this purpose. Tests made by the United States and Canadian governments show that where material of suitable quality can be found, this species serves admirably for airplane construction and may be expected to supplement the supplies of Sitka spruce from the Pacific Coast, which are only now beginning to approach adequate proportions.

The timber for use in airplanes has to be sawed parallel to the bark, instead of parallel to the axis of the log, as is done for lumber. In this way, straight-grained boards are obtained, having the highest possible percentage of material free from knots and possessing a maximum of strength.

ESTHETIC

Two fair munition workers were discussing their personal affairs.

"Got a chap yet, Liz?" enquired one.

"Yes; and he's a regular toff. He's manager at —"

"You don't say so! Why, they tell me he's real refined."

"Rather! Why, he took me to a restaurant last week, and when we had coffee he poured it into a saucer to cool it, but he didn't blow it like common people would—he fanned it with his hat."

The Duty of the Employer in the Reconstruction of the Crippled Soldier

In the Past the Pension System Proved a Failure Constructively — The Only Compensation For Physical Disability is Rehabilitation For Self-support

By Douglas C. McMurtrie,

Director Red Cross Institute for Crippled and Disabled Men, New York City.

SOON after the outbreak of hostilities the European countries began the establishment of vocational training schools for the rehabilitation of disabled soldiers. They had both the humanitarian aim of restoring crippled men to the greatest possible degree and the economic aim of sparing the community the burden of unproductivity on the part of thousands of its best citizens. The movement had its inception with Mayor Edouard Herriot of the city of Lyons, France, who found it difficult to reconcile the desperate need for labor in the factories and munition works while men who had lost an arm or a leg but were otherwise strong and well were idling their time in the public squares. He therefore induced the municipal council to open an industrial school for war cripples which has proved the example and inspiration for hundreds of similar schools since founded throughout France, Italy, Germany, Great Britain and Canada.

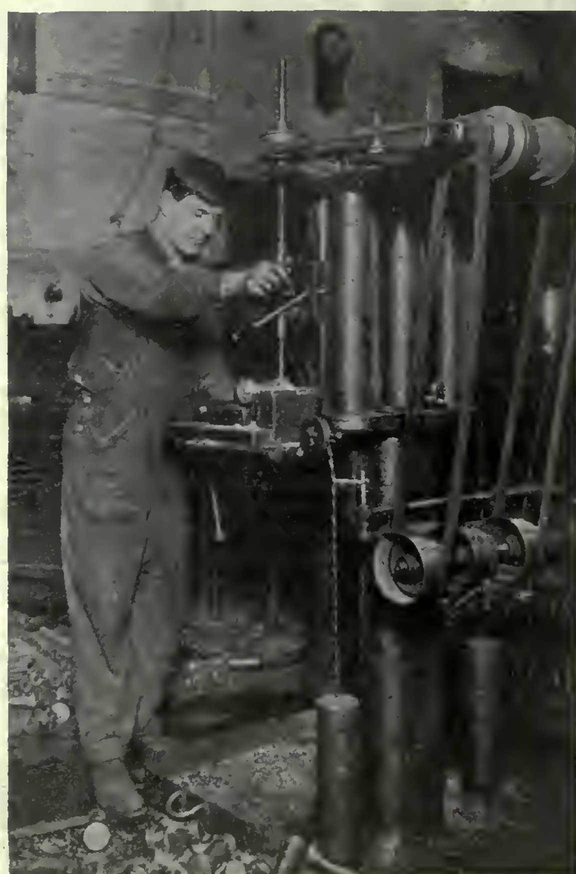
The disability of some crippled soldiers is no bar to returning to their former trade, but the injuries of many disqualify them from pursuing again their past occupation. The schools of training prepare these men for some work in which their physical handicap will not materially interfere with theid production.

Influence of Previous Training

The education of the adult is made up largely of his working experience. The groundwork of training in his past occupation must, under no circumstances be abandoned. The new trade must be related to the former or be, perhaps, an extension or specialization of it. For example, a man who had done manual work in the building trades may be instruction in architectural drafting and the interpretation of plans be fitted for a foreman's job, in which the lack of an arm would not prove a serious handicap. A trainman who had lost a leg might wisely be prepared as a telegrapher, so that he could go back to railroad work, with the practice of which he is already familiar.

Whatever training is given must be thorough, for an adult canot be sent out to employment on the same basis as a boy apprentice. He must be adequately prepared for the work he is to undertake.

The one-armed soldier is equipped witn working appliances which have supplanted the old familiar artificial limb. The new appliances are designed with a practical aim only in view; they vary according to the trade in which the individual is to engage. For example, the appliance for a machinist would be quite different from that with which a wood turner would be provided. Some appliances have attached to the stump a chuck in which various tools or hooks can interchangeably be held. The wearer uses these devices only while at work; for evenings and holidays he is provided with a "dress arm" which is made in imitation of the lost member.



LEARNING THE OPERATION OF A DRILL PRESS.

Avoid Temporary Dependence

An important factor in the success of re-educational work is an early start, so that the disabled man shall have no chance to go out unemployed into the community. In even a short period of exposure to the sentimental sympathy of family and friends his "will to work" is so broken down that it becomes difficult again to restore him to a stand of independence and ambition. For this reason therefore, the plan for his future is made at as early a date as his physical condition admits, and training is actually under way before the patient is out of the hospital.

In the readjustment of the crippled soldier to civilian life, his placement in employment is a matter of the greatest moment. In this field the employer has a very definite responsibility.

But the employer's duty is not entirely obvious. It is, on the contrary, almost diametrically opposite to what one might superficially infer it to be. The duty is not to "take care of" from patriotic motives a given number of disabled men, finding for them any odd jobs which are available, and putting the ex-soldiers in them without much regard to whether they can earn the wages paid or not.

Yet this method is all too common. A local committee of employers will deliberate about as follows: "Here are a dozen crippled soldiers for whom we must find jobs. Jones, you have a large factory; you should be able to take care of six of them. Brown, can you not find places for four of them in your warehouse? And Smith, you ought to place at least a couple in your store."

Such a procedure cannot have other than pernicious results. In the first years of war the spirit of patriotism runs high, but experience has shown that men placed on this basis alone find themselves out of a job after the war has been over several years, or in fact, after it has been in progress for a considerable period of time.

Charity Jobs Deteriorating

A second weakness in this method is that a man who is patronized by giving him a charity job comes to expect as a right such semi-gratuitous support. Such a situation breaks down rather than builds up character, and makes the man progressively a weaker rather than a stronger member of the community. We must not do our returned men such injury.

The third difficulty is that such a system does not take into account the man's future. Casual placement means employment either in a makeshift job as watchman or elevator operator such as we should certainly not offer our disabled

COACH BUILDING IN THE RAILROAD SHOPS.

men except as a last resort—or in a job beyond the man, one in which, on the cold-blooded considerations of product and wages, he cannot hold his own. Jobs of the first type have for the worker a future of monotony and discouragement. Jobs of the second type are frequently disastrous, for in them a man, instead of becoming steadily more competent and building up confidence in himself, stands still as regards improvement and loses confidence every day. When he is dropped or goes to some other employment, the job will have had for him no permanent benefit.

Twelve men sent to twelve jobs may all be seriously misplaced, while the same twelve placed with thought and wisdom and differently assigned to the same twelve jobs may be ideally located. If normal workers require expert and careful placement, crippled candidates for employment require it even more.

Employer's Duty

The positive aspect of the employer's duty is to find for the disabled man a constructive job which he can hold on the basis of competency alone. In such a job he can be self-respecting, be happy, and look forward to a future. This is the definite patriotic duty. It is not so easy of execution as telling a superintendent to take care of four men, but there is infinitely more satisfaction to the employer in the results, and infinitely greater advantage to the employee. And it is entirely practical, even in dealing with seriously disabled men.

A cripple is only debarred by his disability from performing certain operations. In the operations which he can perform, the disabled man will be just as efficient as his non-handicapped colleague, or more so. In the multiplicity or modern industrial processes it is quite possible to find jobs not requiring the operations from which any given type of cripples are debarred. For such jobs as they can fill the cripple should be given preference.

Thousands of cripples are now holding important jobs in the industrial world. But they are men of exceptional character and initiative and have, in general, made their way in spite of employers rather than because of them. Too many employers are ready to give the cripple alms, but not willing to expend the thought necessary to place him in a suitable job. This attitude has helped to make many cripples dependent. With our new responsibilities to the men disabled in fighting for us, the point of view must certainly be changed. What some cripples have done, other cripples can do—if only given an even chance.

The industrial cripple should be considered as well as the military cripple. for in these days of national demand for the greatest possible output there should not be left idle any men who can be made into productive workers.

With thoughtful placement effort, many men can be employed directly on the basis of their past experience. With the disabled soldiers who profit by the training facilities the Government will provide, the task should be even easier.

A Patriotic Duty

This, then, constitutes the charge of patriotic duty upon the employer:

To study the jobs under his jurisdiction to determine what ones might be satisfactorily held by cripples. To give the cripples preference for these jobs. To consider thoughtfully the applications of disabled men for employment, bearing in mind the importance of utilizing to as great an extent as possible labor which would otherwise be unproductive. To do the returned soldier the honor of offering him real employment, rather than proffering him the ignominy of a charity job.

If the employer will do this, it will be a great factor in making the complete elimination of the dependent cripple a real and inspiring possibility.

Maintaining a constant water level irrespective of the rate of evaporation affords considerable protection to the boiler, inasmuch as the danger of low water is removed, and the danger of injuring the engine or other steam-using machine, due to slugs of water being carried over from the boiler is entirely eliminated.

A POINT deserving of attention from brass founders is the marking of runners with a certain mark for each class and mixture of metal. In some cases the molder can put a certain mark with his tools, but if a stamp be used to denote each particular mixture, the men who chip off the runners can easily distinguish what class of metal it is made from, and the scrap gates can be kept quite separate.

RECEIVING INSTRUCTION IN THE MACHINISTS' TRADE.

Good Progress Made at Dominion's New Plant

Actual Building Operations Were Under Way Before the Shops Were Completed—Excellent Progress Has Been Made on the Work

GOOD progress is being made in the construction of the new plant for the Dominion Shipbuilding Co. at the foot of Bathurst street, Toronto, and actual shipbuilding operations are under way although the shops are not completed.

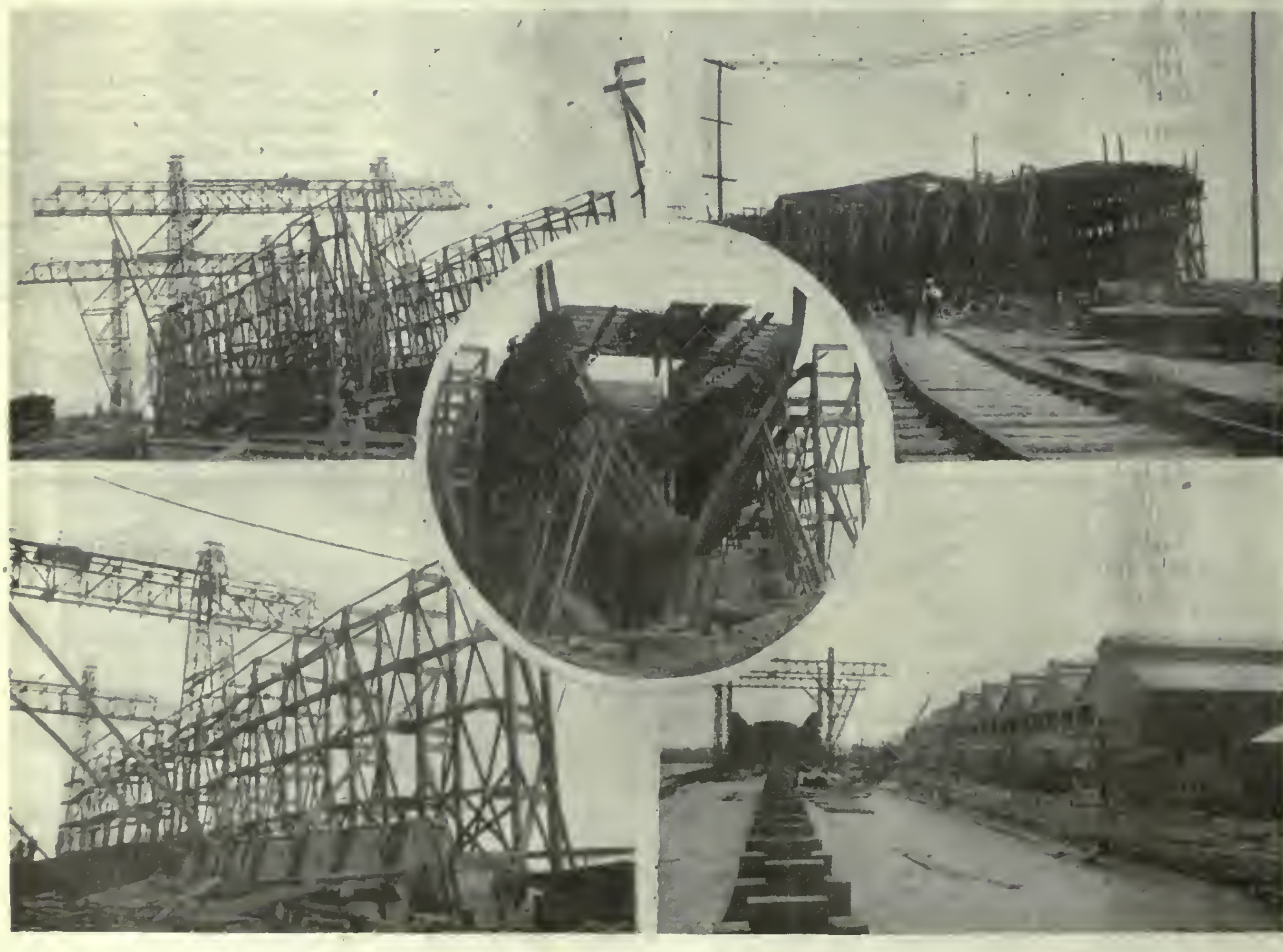
The main building is 485 feet by 210 feet divided into two sections, the first section comprising the plate shop and the second section the joiners shop with mould loft above. The power plant is also included in the main building while the furnaces are in an annex adjoining the eastern end of the plate shop.

The building is of steel construction with steel roof trusses while the outside walls are fireproof, being made of steel mesh treaded with "Gunite." All partitions walls are of hollow tile construction. The windows have Finestra steel sash. The roof of the plate shop is corrugated iron while the roof over the mould loft is made up of boarding covered with built-up roofing material. The steel work was supplied and erected by the Dominion Bridge Co.

The furnaces for heating angles and ship shapes etc., which are oil fired, were designed by John Main and installed by the Canadian Incinerator Co., Toronto. A considerable section of the floor in one bay of the main building is laid out for working up angles and other shapes. The other four bays of the plate shop each have a "Northern" electrically operated, overhead, travelling, 3 ton crane, while the equipment consists generally of punching and shearing machinery, etc., for fabricating plates, etc., for the ships under construction. All the machines are motor driven. Some delay has been experienced in obtaining the woodworking machinery, otherwise the joiners, shop would now be in operation.

The foundations have been laid and steel work has been erected for another building which will be 325 feet by 155 feet and will take in the machine, blacksmith, pipe and electrical shops. The construction of the second building will be similar to the first. In order to carry on the construction of the ships, while the new shops are being erected temporary woodworking and blacksmith shops and stores, etc., are being used. It is expected that the new plant will be completed and in operation this Fall. The site of the plant covers about 16 acres and is practically all made land. The concrete retaining walls were constructed and the site made by the Toronto Harbor Commission, being part of the scheme for developing the harbor front.

At the present time one hull is being plated and keels laid for two other huls. The company expects to deliver three ships this season including one, the "Troja," which left in June for Montreal in ballast. Over the shipbuilding berths are the electrically operated gantries having a span of 68 feet. Both these gantries are complete except for the motors which have not been installed yet. There are five berths altogether, so the company will be able to build that number of ships at a time when the plant is finished. The Dominion Shipbuilding Co. will have a plant up-to-date in every feature and a valuable acquisition to the shipbuilding industry in Canada. Construction work on the plant was started in December, 1917, and considering the severe weather in the winter and difficulty of obtaining steel excellent progress has been made with the work.



VIEWS TAKEN AT THE PLANT OF THE DOMINION SHIPBUILDING CO.

The Types and Industrial Uses of Pyrometers

The necessity for accurate temperature control of industrial processes has led to the development of the various types of pyrometers in present day use, from the delicate laboratory appliance to that of an industrial manufacturing appliance. The following article reproduced through the courtesy of Alfred Herbert, Ltd., illustrates some of the types and their uses.

THERE is no need, at the present time, to insist upon the necessity for pyrometers in connection with heating processes, because that necessity is well recognized.

Contrasting the position to-day with that which existed say fifteen years ago, we find that the pyrometer has advanced from the limited position of a delicate laboratory instrument to that of an industrial manufacturing appliance. When the pyrometer was only to be used in the laboratory, in the hands of specially trained experts, the problem, from the point of view of the instrument maker, was relatively simple, although the instrument maker did not so consider it in those days. The laboratory pyrometer made occasional excursions into the works, usually with disastrous results, at any rate, to the pyrometer.

However, it became obvious that the information, with regard to the influence of accurate temperature regulation upon the resulting product could not be of any industrial value unless pyrometers could be applied to the industrial heating processes involved, therefore it was necessary to design pyrometers which could be used safely in the works.

The time has now come when the user of pyrometers under industrial conditions should know more about the principles upon which those instruments operate, the various factors which enter into the design and successful application of any type of pyrometer to industrial heating processes.

Pyrometer Classification

Pyrometers may be divided into two broad classes as follows:

"A." "Contact" or inserted pyrometers, in which some portion of the apparatus is actually subjected to the temperature to be measured such as:

1. Expansion instruments, the mercury-in-glass thermometer, and various other types in which differential expansion of some kind, either liquid or solid, is the means of measurement.

2.—The electric resistance thermometer, depending for its action upon the change in resistance by a coil of wire when its temperature changes.

3.—The thermo-electric or thermocouple pyrometer, depending for its action upon the electro-motive force or voltage developed at the junction between two dissimilar metals or alloys when that junction is heated to a temperature different from the remainder of the electric circuit.

4.—Melting-point pyrometers, in which the melting of some alloy or mixture of salts or clay indicates the passage above a certain fixed temperature, these may be termed "fixed point pyrometers."

"B." "Distant" pyrometers, in which no part of the instrument is subjected to the actual temperature to be measured, but which operates entirely at a distance from the hot body under measurement, comprising:—

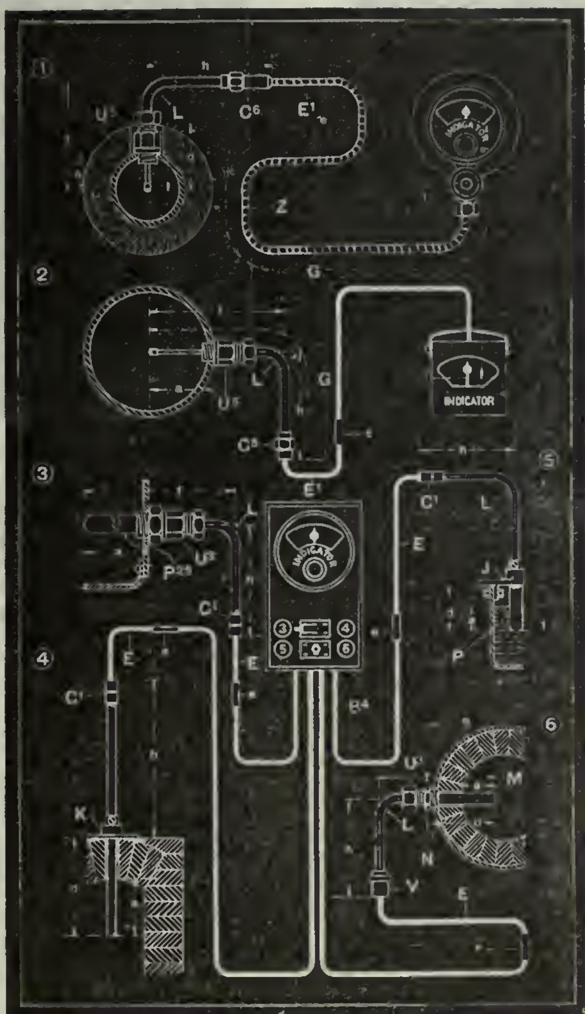


FIG. I.

5.—The optical pyrometer, in which the measurement of temperature is made by matching the brightness or color of the hot body against that of a standard in the instrument and computing the temperature by the adjustment which has to be made in the instrument.

6.—The "total radiation" pyrometer, which measures the temperature of the hot body by means of the radiated energy therefrom, both luminous and non-luminous.

Variation In Indications

It must be remembered that a pyrometer in which the sensitive portion is subjected to the temperature measures actually the temperature of its sensitive portion. It is clear that the temperature of the "hot junction" may be different from the material in the furnace, bath or other apparatus, due to the conditions briefly mentioned below.

(a) Thermal conduction of the pyrometer sheath. It is usual, and generally necessary, to employ an outer sheath to protect the actual thermo-couple from the action of the furnace gases or the material in a bath. Heat is transmitted from the furnace gases or bath through the sheath to the thermo couple "hot junction," and if this sheath is of large cross section some of this heat will be conducted away along the length of the sheath and will not reach the thermo-couple. This lost heat may result in the thermo-couple junction being at a lower temperature than the furnace or bath if sufficient depth of insertion is not provided.

(b) Temperature inequality in the furnace or bath. In direct fired furnaces, particularly when the door or other opening is large in relation to the furnace and is opened frequently, large differences may exist between different parts of the furnace.

(c) Unless the material which is under treatment is left in the furnace or bath a sufficient time it will not attain the temperature of the furnace, and therefore may be at a much lower temperature than that measured by the inserted pprometer.

These conditions and limitations apply with equal force to other types of pyrometer than the thermo-couple—in fact, in the case of the electric resistance or expansion instruments the larger bulk of the sensitive portion may aggravate the resulting errors.

Suitability of Contact Pyrometers

From the foregoing considerations it will be clear that the "contact" or inserted pyrometer is suitable for those cases in which the material under treatment remains in a closed furnace or in a bath for a time sufficient to ensure reasonable equality of temperature, and to cases in

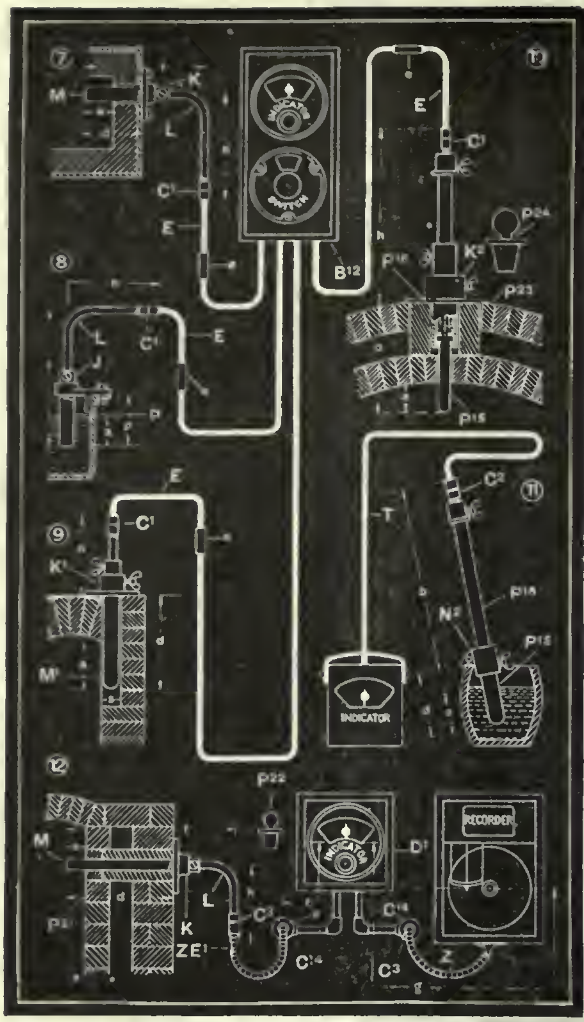


FIG. 2.

FIG. 3.

which the furnace temperature, as measured by the pyrometer, is kept at a steady figure and the material, of uniform heat capacity, is fed into and out of the furnace at a uniform rate.

Distant Pyrometers

Turning to the "distant" pyrometers, optical or total radiation, the measurement being made by the radiated light or heat, the pyrometer, if correctly used, will measure the temperature of the surface presented to it. That surface may be the inner wall of a furnace or the material in a furnace. The use of a radiation or optical pyrometer is subject to the following limitations:

(d) Unless the pyrometer is specially calibrated for other conditions, the hot body under measurement must be within a deep enclosure which is fairly uniformly heated. If these conditions do not obtain the measurement will be dependent upon the reflecting power of the surface of the hot body. It is, however, possible to calibrate these pyrometers for given surfaces out in the open or to apply a factor to the observed reading.

(e) The heat or light radiated from the hot body to the pyrometer must not be intercepted by smoke or gases containing solid particles. In the case of the optical instrument luminous flames, even though not containing solid particles, may, nevertheless, affect the reading very largely. The "total radiation" instrument is very little affected by clear flames, hence this latter type is frequently preferable for use by relatively unskilled observers.

The remarks under (d) and (e) show that the "distant" pyrometer is particularly suitable for work of an exploring nature and for the measurement of temperature of individual pieces of material or particular parts of a furnace. It is also, of course, preferable where the temperatures to be measured are very high and where consequently the life of the thermo-couple sheath and sensitive tip would be short.

The "total radiation" instrument has the advantage of being practically automatic in action, so that it can be used as a simple indicating or as a recording instrument, it does not require manipulation or adjustment by the user. It has the disadvantage of requiring a relatively large hot body surface for measurement, though this disadvantage is more apparent in the laboratory than in works practice.

The optical pyrometer can not be made directly indicating or recording, it depends upon the adjustment by the user to make a measurement. It is, however, useful when the hot body under measurement is small.

Turning again to the thermo-couple pyrometer, experience shows that the detail arrangement and application of the instrument to the furnace or bath have a very large influence upon its success.

Pyrometer Location

If the pyrometer is inserted through the crown of the furnace, as shown at Station 4 in Fig. 1, and projects deeply into the furnace space, it is frequently found to be in the way of the work in the furnace. If the same position is retained and the depth in the furnace reduced, one or two troubles may be met. If the furnace is uniformly heated the pyrometer may read low due to insufficient depth of insertion. If, alternatively, the furnace is heated largely by radiation from the furnace crown and flames at a higher temperature are passing along under the furnace crown to maintain its temperature, then the pyrometer will have its hot junction directly in the path of these flames, and will tend to measure their temperature rather than that of the material in the furnace. Added to this trouble is the fact that the life of the pyrometer sheath would be short under these circumstances.

Occasionally insertion through the side of the furnace is preferable in the manner shown at Station 7, Fig. 2, though the same class of difficulty may arise here. A preferable method of insertion is shown at Station 9, in Fig. 2. In this arrangement a pocket or channel is cut in the side of the furnace and the pyrometer sheath installed therein. In this way the flames in the furnace will not impinge directly upon the sheath, the sheath being heated largely by radiation from the furnace walls and from the material in the furnace.

In a large number of furnaces the arrangement is such that the pyrometer sheath has to cross an outer fire or flue space before reaching the working space of the furnace, and here again special consideration must be given to the details of installation. The gases in this fire space may be at a temperature very different from that in the working space of the furnace, and this temperature will influence the reading of the pyrometer unless particular care is taken to keep that temperature away from the sensitive tip of the pyrometer. Two different methods of installation are shown at Stations 10 and 12, in Fig. 2, to meet such cases.

When considering the application of the pyrometer to a bath of molten salt or metal, the sheath is extremely important, but it is not at all easy to secure a satisfactory sheath where the temperature is high. The bath, however, has the great advantage of giving good heat conduction from the bath to the sheath and approximate equality of temperature in various parts of the bath. Typical methods of installation are shown at Station 5, Fig. 1, and Station 8, Fig. 2.

In the foundry work on low melting alloys, non-ferrous alloys and aluminium constitutes a field in which the use of the thermo-couple pyrometer is being rapidly extended. Previous to the adoption of the Hoskins' alloys nickel-nickel chromium, there was no practicable thermo-couple which could be inserted unprotected by a sheath in these metals, the alloying effect was so great that the thermo-couple was destroyed after a very few readings.

The use of a sheath, as indicated at Station 11, in Fig. 2, is legitimate only where the time lag due to the heat capacity of the sheath is not an objection. Usually in foundry work the time lag of the sheath is an objection, and fortunately in such cases the Hoskins' alloy thermo-couple provides a solution of the problem.

It is made with fairly thick wires, and the tip of the thermo-couple is inserted directly into the molten metal, but removed as soon as a steady reading is attained. The thermo-couple wires are alloyed away by the molten metal at a rate varying with the nature of the alloy being melted, but with non-ferrous alloys and aluminium this rate is sufficiently slow to enable a large number of readings to be made before a thermo-couple renewal is necessary. When that renewal is necessary its cost is not very large, therefore the method is commercially justifiable.

After the fused junction between the two alloys has been destroyed by the molten metal the metal itself forms a junction so that this use of the pyrometer can be continued without making a new junction.

Details of Electric Circuits

Time and money spent upon the details of the electric circuit of a thermo-couple pyrometer are a good investment. It is a mistake to wire up a pyrometer with "bell wire." It has been found that heavy cable well protected—as, for instance, by screwed conduit, as shown at Station 12, Fig. 2—is well worth the time and trouble taken in the first installation. Similarly switch connections should be large, simple and easily adjusted. It should be remembered that the voltages available in pyrometer circuits are extremely low, frequently only small fractions of a volt and that circuit accessories which are quite suitable for lighting or power circuits will not give reliable results in a pyrometer circuit, the voltage is not enough to break down a film of oxide or other surface corrosion.

The indicating or recording instruments to be used with the thermo-couple should be sufficiently robust to withstand the unavoidable rough usage frequently met with in industrial work. Delicate suspensions are quite out of place in the works. Notwithstanding the maximum robustness attainable, it is advisable to choose favorable positions for instruments which are permanently installed.

Radiation Pyrometers

In the case of the "total radiation" pyrometer protecting sheaths are not required, and therefore the application of these instruments is in many cases much simpler. In view of the valuable exploring service which can be obtained from a radiation pyrometer, that instrument is most frequently made in a portable form, though there are many cases also where it is permanently installed as a recording instrument.

When considering a hot body inside a furnace or other approximately uniformly heated enclosure, the temperature measured is that of the surface presented to the instrument. For instance, at Station 1, Fig. 3, the surface being measured is the back wall of the furnace.

At Station 2 the peep hole has been coned out to allow of measurement of the temperature of the hot bodies lying on the floor of the furnace. This figure also indicates a method whereby a number of hot bodies being treated together may be made to provide a large enough surface for the pyrometer, although individually the hot bodies are small.

In Station 3 the door is shown raised to measure the temperature of the hot body "c."

As previously mentioned, the radiation pyrometer requires a relatively large hot body, but where a single small hot body is under treatment it is possible to measure its temperature if it is allowed to rest upon the floor of the furnace or against the wall of a furnace and to heat up until, by the eye, it has the same brightness as the surface against which it rests. Station 4 in Fig. 3 illustrates this method of use.

In using a radiation pyrometer it is, of course, necessary to prevent flames from the furnace reaching the pyrometer; it is equally necessary to prevent furnace gases from entering the pyrometer receiving tube, although these gases may not be visible as flames. There is usually little chance of this happening, but where the danger does exist it may be guarded against by arranging a cross blast of air to blow away any flames or products of combustion which might otherwise enter the receiving tube of the pyrometer. Such an arrangement is shown at Station 4, Fig. 3.

In the foundry the radiation pyrometer is useful for exploring the temperature of a pot furnace. In order that the temperature as measured may be independent of the nature of the surface under measurement the lid of the furnace is only partially removed, as shown at Station 6, Fig. 3.

Station 7 shows a method whereby the radiation pyrometer is used upon an adjustable bracket for permanent work as, for instance, a recording instrument.

As mentioned previously, the radiation pyrometer may be used, by means of a special calibration, upon hot body surfaces which are out in the open and not in uniformly heated enclosures. In such cases the reflecting power of the hot body must be taken account of.

Any surface which has reflecting power will radiate less energy than a non-reflecting body; it is not what is known technically as a "black body," that is, it is not a body which would appear dead black if it were cool.

Fortunately the oxidised surfaces of iron, steel, copper, whether molten or solid, radiate with an efficiency which is approximately a uniform percentage below that of the "black body," therefore the radiation pyrometer may be calibrated for use under such circumstances with sufficient accuracy for industrial purposes.

For instance, the temperature of a forging under the hammer may be measured, without interrupting the process, in a manner indicated diagrammatically at Station 8, Fig. 3. Of course, in such cases, it is necessary to remove dross or any non-adherent scale before a measurement is made.

When Le Chatelier first developed his thermo-couple pyrometer he employed thermo-couple wires of pure platinum against platinum alloyed with 10 per cent. of rhodium. He chose these wires because they were of high melting point and were relatively unalterable.

It has subsequently been found, however, that these wires are influenced seriously by reducing gases and the metal vapors which may exist in those gases. The wires become crystallized and also suffer a fall in E.M.F., and therefore a change of calibration, frequently of large amount, before the wires fractured.

Owing to the high expense of platinum in these alloys the wires are necessarily very thin and therefore liable to rapid attack, while the user is tempted to continue their use as long as possible owing to the very high cost of replacement.

Having chosen the alloys, the problem was then to devise a galvanometer suitable for use as an indicating instrument. The alloys, being expensive, were used in the form of very thin wires, about a fiftieth of an inch diameter; they were therefore of high electrical resistance and subject to a large increase in resistance when heated up in the furnace. In order to mask the change in calibration which would follow this increase in resistance, an indicating instrument was used which had a very high internal resistance so that the change in resistance in the circuit was relatively small. Since the copper wire in the coil of this indicating instrument was itself subject to an increase in resistance when the instrument became hot, a further "ballast" resistance had to be added in the form of a wire whose resistance did not increase when heated up. The net result of this high internal resistance was an instrument having very weak moving forces, because the electro-motive force or voltage of the platinum-platinum rhodium thermo-couple was in itself very small.

The discovery that "base metals"—that is, cheaper alloys—could be used as reliable thermo-couple opened up a new field in pyrometry, and it has been found that for all except very high temperatures the base metal thermo-couple forms a reliable industrial pyrometer. The Hoskins' alloys, nickel-nickel-chromium or nickel chromium-nickel copper have the advantage that they are much cheaper than the platinum alloys, and therefore may be used in the form of thick wires, and the further advantage of a much larger electro-motive force. As the wires are thick they are of low resistance, and fortunately also they have very small increase in resistance when they are heated up in the furnace. Therefore the necessity of having an indicating instrument of high internal resistance is no longer usually prominent. If the whole circuit resistance is low the current flowing in the circuit will be proportionately larger, and the net result is that the moving forces in a low resistance "base metal" pyrometer using the Hoskins' alloys are of the order of fifty times as great as those of the high resistance platinum alloy pyrometer. The gain in robustness and suitability for industrial work will be obvious.

It has been pointed out already that a sheath is necessary to protect the thermo-couple, as far as possible, from the influence of contaminating vapors. In the case of the platinum alloy thermo-couple this sheath must be literally impervious to gases. Unfortunately, the only materials which can approach this condition of imperviousness are, in themselves, fragile—for instance, silica (quartz) or glazed porcelain. In industrial work it is the sheath which sets the practical limit to the temperature at which a platinum alloy thermo-couple may be used, and this maximum temperature is unfortunately many hundreds of degrees below the melting point of the thermo-couple wires, therefore the fact that the melting point is very high is really of no practical value.

Admittedly, the base metal alloys have much lower melting points, but since the question of the sheath sets the limit still lower than the melting point, this fact is of small practical interest under industrial circumstances. To formulate an approximate general rule it may be said that above 1,000° C. for continuous work or 1,300° C. for intermittent work, no thermo-couple could be used under industrial conditions usually obtaining. For this reason the preference for the radiation pyrometer becomes greater as the temperature increases.

Of course the adoption of the low resistance circuit is quite out of the question with a platinum alloy thermo-couple, but the low resistance circuit cannot be advanced as an entire disadvantage to the base metal thermo-couple because the conditions of mechanical robustness would usually make advisable a fairly heavy gauge of copper connecting wire, and in any case the cost of the copper connections is relatively a small fraction of the total installation cost. In the choice of a sheath for a base metal thermo-couple the field is very much wider; metal sheaths may be used with consequent increase in mechanical robustness and reduction in cost. The Hoskins' nickel chromium alloys cast in the form of a sheath give particularly good service under severe conditions up to about 950° C. Of course, such a sheath cannot be used with a platinum alloy thermo-couple because the metal vapors emanating from the sheath itself would contaminate the thermo-couple.

To be continued

THE IRON SITUATION IN JAPAN

On account of the iron and steel situation in the United States, where, because of successive orders placed by the government for military requirements, and the increasing private demands that have developed in that country the demand has greatly exceeded the supply, the manufacture and delivery of steel for exportation to Japan cannot be undertaken unless the government's orders are first completely filled. Because of these government restrictions, even the orders already contracted for, to say nothing of new orders, cannot be shipped abroad without the government's consent, so naturally delay is inevitable. The question of how long this situation may last cannot be easily fathomed. At any rate, for the present the import of American iron into Japan cannot be proceeded with satisfactorily.

In anticipation of higher quotations that may result, exporters and manufacturers in the United States are induced to make conditional contracts for Japanese orders consequent upon the difficulty in obtaining licenses to ship. On the other hand, Japanese merchants are holding over their orders fearing any future turn of events. This naturally results in the gradual decrease of imports, and it is impossible to know what change may occur in the market so long as imports of iron and steel cannot be carried on satisfactorily.

The price of iron has run up over 20 per cent. during the last month, while plate iron has also advanced, due to shortage of stocks. The ordinary inch goods rule at yen 45-46 per 100 kin, and the two-fifth inch goods in the neighborhood of yen 46-47 per 100 kin.

In the early part of May two-fifth inch goods were somewhere in the neighborhood of yen 1,100 per ton, but now the price of yen 1,200 is reached. Rod iron has had a sharp rise within the last few days, and at the same time the market for such has been very busy. Round iron, on account of its cheaper quotations, advanced also, the ordinary inch goods being quoted at yen 14, and the square goods at yen 15-19 per 100 kin. Nails and other minor goods have considerably stiffened, 3-5-inch to 1 1-5-inch goods bringing yen 32 per 100 kin.

Galvanized plate iron rules higher by yen 3-40 to yen 3-50, while galvanized wire has advanced about 5 per cent. All of these have advanced by 20 to 30 per cent. since last week. It is thought that another strong tone may prevail with the difficulty in importing American iron goods.

UTILIZATION OF WESTERN LIGNITE

A plan for the utilization of Western lignite that is likely to have far-reaching results has been formulated by the Council for Scientific and Industrial Research, of which Dr. A. B. Macallum is chairman.

The provinces of Manitoba and Saskatchewan import annually from Pennsylvania about a half million tons of anthracite for domestic fuel, and send out of the country, therefore, more than $4,000,000. There are in these provinces it is estimated, about fifty-seven million tons of lignite of a poor grade, and consequently, disqualified from serving as domestic fuel. It has been demonstrated, however, that they can be carbonized and briquetted, and that the product thus created is an equivalent of anthracite.

As a result of these investigations, conducted by the lignite committee, of which R. A. Ross, of Montreal, is the chairman, the council recommend that the government establish a plant in southern Saskatchewan to turn out 30,000 tons of this fuel yearly, the estimated cost of which would not probably exceed $7 per ton at the plant. The three governments concerned are about to sign the proposed agreement, the Dominion Government having already involved its share of the total cost of the plant. The governments expect to appoint the commission to operate the plant at an early date.

CONTINUOUS SHELL, HEAT TREATING FURNACE FOR 75 AND 155 M.M. WORK

A CONTINUOUS furnace for heat-treating 75 mm. and 155 mm. shells is being manufactured by the Strong, Carlisle & Hammond Co., Cleveland, Ohio. This furnace, which can be used for both hardening and drawing operations, is of the underfired type, constructed with a working tile floor 27 in. wide by 20 ft. long. In operation the flame from the gas or oil burners enters a combustion chamber beneath the working tile floor, and the products of combustion escape through ports in the arch. The furnace shown in the accompanying illustration is oil-fired from burners at the side and is being used for treating 75 mm. shells. In heat-treating 75 mm. shells, four rows of shells are passing through the oven at a time, and each row is supported by two 1½ in. steel bars. The nose of one shell pushes against the base of the shell just in front of it. At the charging end of the furnace is a table supporting the shells and also two cross-heads that move horizontally. Each cross-head pushes two rows of shells through the oven. The cross-heads are moved back and forth by means of two cranks that are rotated by means of a worm gear and worm. The balance of the drive consists of a pinion, gear and two cone pulleys. The cone pulleys are used so that the speed can be slightly varied. In heat-treating larger shells up to 155 mm. the charging end of the furnace is equippel with a hydraulic ram in place of the crank arrangement described above. The manufacturers can supply a master clock and bells so that the bells will ring at certain intervals and notify the operator that the hydraulic ram is to be operated. When fitted with this arrangement the furnaces for the larger shells are not automatic like the furnace for heating the 75 mm. shells.

The furnaces are shipped from the factory completely set up and crated. Upon arrival at the customer's plant it is only necessary to remove the skids and make one air and one oil connection for the burners.

The hood over the charging end as shown in the illustration was installed to carry away the heat which helps to keep the room cool. The pullies and belt shown at the left hand of the illustration drive the crank feeding arrangement. The quenching tank is shown at the far end of the furnace.

CONTINUOUS FURNACE FOR HEAT TREATING 75-MM. SHELLS.

BECOMING AN ENGINEER

By Batiste Lefore

My name is Batiste Lefore, I am ze french mans, I have been having ze troubles wis ze steam plant las week.

I was ze sweep de floor man in ze factory but every time de engineer clean out dose boilers he ask for Batistee to help hem. Well dat engineer he go to fight de hun and me Batistee being old fellow, I stay home. De boss say Batistee, how you like to be engineer and mak tree dollar a day. I say, sure for dat is fine job, all dere is to do is shovel in coal to keep dat steam up, oil up de engine and shafting, lace de belts, sharpen de knives, wash de windows, and sit down when nobody can find anyting for me to do. Sure, I make a grab for such a snap and de next morning I am on de job at 5 a.m. I fill up the fire hole wid coal and at 7 a.m. de whistle I blow for start work, de big valve called safety she be blowing at de same time.

After awhile de Boss come in and say, damn it Batistee why you let dat safety valve below. I say I tink she do dat for safety. He look at de glass and say where is de water, I tell him it is in de boiler I nevaire take eet out. He yelled pull out your fire or she will blow up, den he runs away and I runs after him. Well pretty soon de fire goes out and we get the boiler men to fix her up again and de boss show me how to put in de water and say do not let the safety valve plow so much. I am getting on fine and one day when I am painting de walls a feller comes in and says are you de engineer, I tell him I am him. He say I am inspector Dan Sharpise. Where is your certificate? I say, what is dat. He say a licence. I tell him I am not a dog and do not need a tag. He say you go to dose examiners and get a licence or I put you in ze coop. I say sacre, I not go in any hen coop. I go to see dese examiner fellow. He say Batiste vos you an engineer? I say sure. He say describe de engine you run. I tell him dere is a pipe to take de steam in and anoder one to take it out and a rod runs out and in and turns de wheels around. McGee he say. Ha name de valve on de engine. I tell him de only valve on de engine is de one de Boss called de trottle. He say, hang it man, I mean de valve in de steam chest. I tink dat McGee he been having some 2½ per cent. to talk about chests on de engine.

He ask me do I know how much lead and lap de valve him got. I start to laugh for I tink he joke me. I say sure McGee. I tie de string to dot valve and lead him around de mill and let him lap up some milk like a cat. Den McGee be get red in de face and say damn some times more. Den McGee ask me if it is good plan to put valve between boiler and safety valve, and I say, sure, because if I had valve dere I could shut him when de steam gets high pressure. He say damn again. He say to me I expect if de water got out of de glass and a big fire on you would run away. I say, sure, again, dat is just what I did do a little while ago. He say, see here Batistee, you no damn good as an engineer, go away and learn sometings and come back next year. Anyhow I am going to write to dose correspondence schools on Yongs street, Toronto, and pretty soon I will be a mail order engineer wid a salary of $3 a day, and noding for Sunday or overtime work. By gar, dere is a lot to learn in dat engineering.

The best blowoff valve arrangement is to place a quick-opening straight-way valve next to the boiler with an asbestos-packed iron body plug cock of the angle type at the elbow connecting the straight blowoff pipe with the main blowoff line connection.

The hottest part of the boiler furnace is just behind the bridgewall and frequently it will be found that more scale is thrown here than at any other point.

Principles & Practice of Mechanical Sketching & Drawing-IV

Every Mechanic Should Know How to Make and Interpret Mechanical Drawings and Sketches of the Simpler Types—A Practical Course Prepared Especially For Younger Men and Newcomers in the Industry

By Terrell Croft

ORTHOGRAPHIC PROJECTIONS

MAKE your drawing tell the whole story. Remember that mechanical drawing is a language, and that any working sketch which you may turn out is a graphic description of what is to be made or done. If the sketch is incomplete—if it lacks the requisite dimensions or views or details—the result is the same as when an author omits certain important words from his book. Be always certain that the ideas which you desire to convey are shown completely. Don't be selfish when you make a sketch, but consider that probably others besides yourself may have to work from or refer to it in the future. Details count for much in mechanical drawings.

If the thing is considered solely from the standpoint of economics it can be demonstrated readily that it is extremely wasteful to omit proper information from drawings. The pattern-maker, the machinist, the erector, and others down along the line may spend an aggregate of hours in ferreting out from a sheet facts which could have been incorporated in a few moments by the originator of the sketch.

Proportions and Perspective

Practically all working drawings are orthographic drawings, and the different "views" which comprise them are orthographic projections. While orthographic is rather a long and awkward word, it is used so frequently that it is essential the serious student of the language of lines (mechanical drawing) understands precisely what it means. It is the intention, therefore, to now examine the situation rather minutely. The underlying principle is very important because, as suggested above it is the basis of practically all engineering drawing. If a man once masters the principles which it is proposed to discuss, he will thereby be saved much future time and trouble—both in the making and in the reading of working drawings.

What the word "orthographic" means may be ascertained by referring to any standard dictionary. There it will be found that it is applied not only to drawing but to music and to grammar. In each case orthographic relates to the rendering of a thing in its true sense or true proportion. Thus, orthography in grammer relates to the correct spelling of words. Orthography in music has to do with the representation of tones and effects by the proper characters. An orthographic drawing is one which is in correct proportion.

There is a distinction between an orthographic and a perspective drawing. In an orthographic drawing (for example any ordinary working drawing) the lines are in their true proportions. In a perspective drawing the lines are not in their correct proportions although they appear to the eye to be so. If, in a perspective drawing the lines are in their correct proportions they will not appear to the eye to be correct.

For example, consider the perspective drawing (Fig. 1) of the steam chest cover. This appears to the eye to be in proportion and to be a fair representation of the object under consideration. However, since this is a perspective drawing it is really not in proportion. As shown in Fig. 2, which is a reduced reproduction of Fig. 1, the lines extending away from the realer intersect at a vanishing point P. It is apparent then that in Fig. 1 the line LG is shorter than the line EF, whereas in the actual object we know that these two lines representing edges would be of precisely the same length. Also in Fig. 1 GK is shorter than FJ, while in the actual cover they would be of exactly equal dimensions.

Orthographic Projection Necessary

From a consideration of the facts outlined just above it is evident that perspective drawings are not suitable for general engineering purposes for which it is usually desirable to represent edges,

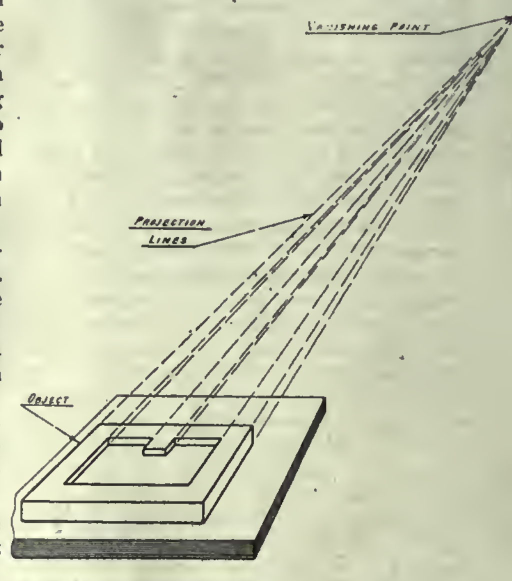


FIG. 2—SHOWING HOW THE LINES OF A PERSPECTIVE DRAWING MAY IF PROJECTED INTERSECT AT A DISTANT POINT.

surfaces, and corners in their true proportions. But with orthographic drawings this requirement of true proportion is satisfied, as will be described.

The function of a working drawing or working sketch is to show on one plane —the surface of the paper upon which the sketch is made—a picture of the object under consideration. The object which the drawing shows has three dimensions—length, breadth and thickness —while the plane upon which the drawing is made has only two dimensions, length and breadth. By utilizing the principles of orthographic projection it is, as will be shown, possible to plot on the apper plane a picture (usually comprising two or more views of the object in question) which will show it in true proportion and in all of its details.

An example illustrating how an object may be shown in orthographic drawing is given in Fig. 3. If the steam chest cover of Fig. 1 be observed with only one eye (E, Fig. 3) open, the observer, standing so that he is directly in front of the center of the object, will then see merely a rectangle (A^1 and B^1, Fig. 3). If now a sheet of glass, S_1, be inserted at right angles to the line of vision and on this glass a trace of the rectangular

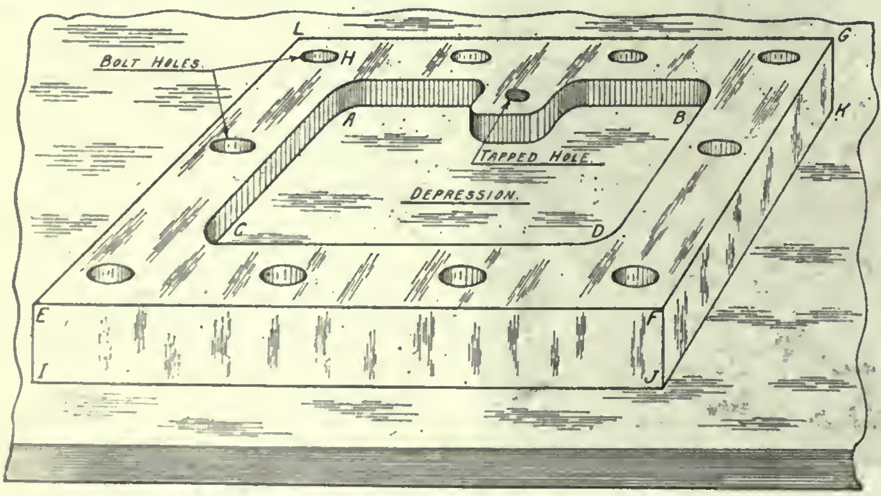


FIG. 1—PERSPECTIVE VIEW OF STEAM CHEST COVER

outline as it appears to the observer be made with, say a pencil of soap, this trace, AB, will also be a rectangle. This rectangle will, obviously, be an orthographic drawing of the front of the steam chest cover because it is a reproduction in correct proportion of the front of the cover. But it is apparent that this one front view of the cover does not give sufficient information to enable a manufacturer who has never seen the cover to reproduce it in his shop. This front view tells nothing as to the depth or the contour of the body of the casting. If, however, another glass sheet (S_2, Fig. 4) be arranged directly over the cover and at right angles to sheet S_1, then the top view of the object can be traced with the soap pencil on this glass pane. The front and top views thus obtained give considerable information relating to the construction of the cover but do not define it completely. To insure more adequate definition another end view (E_1 and E_2, Fig. 5) can be traced if the cover is arranged in a glass box on the end of which the end-view trace is drawn with the soap pencil.

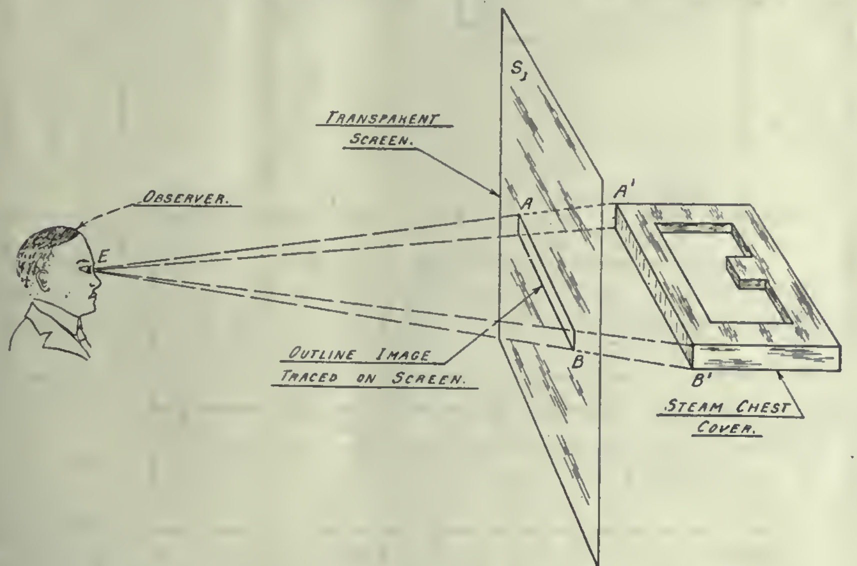


FIG. 3—ILLUSTRATING THE IDEA OF ORTHOGRAPHIC PROJECTION.

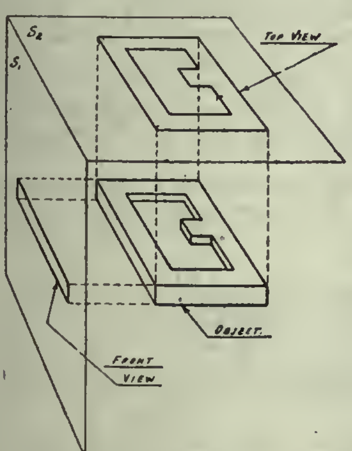


FIG. 4—TOP AND FRONT VIEWS OF STEAM CHEST COVER TRACED ON TWO GLASS SHEETS WHICH ARE ARRANGED AT RIGHT ANGLES TO ONE ANOTHER.

Complete Views

These three views traced on the faces of the glass box—the front view, the top view, and the end view—completely determine the over-all dimensions and the contour of the object. But, as drawn on the glass box in Fig. 5, each of the three lies in a different plane. If the information which these views convey is to be transferred to a sheet of drawing paper, all three of the views must somehow or other be transferred to the same plane. How this may be done is delineated in Fig. 6. The glass sheets upon which the end view and the top view were traced have each been swung through an angle of 90° so that now they all lie in the same plane with the sheet upon which the front view was drawn. In Fig. 6 these three views have been shown shaded to insure that they will stand out clearly. In the actual drawings on the glass the views would, of course, appear in outline as shown in Figs. 4 and 5. If a piece of tracing cloth or paper be stretched over the glass plates of Fig. 6, we could then trace on this sheet the orthographic drawing of the chest cover, which would appear as shown in Fig. 7.

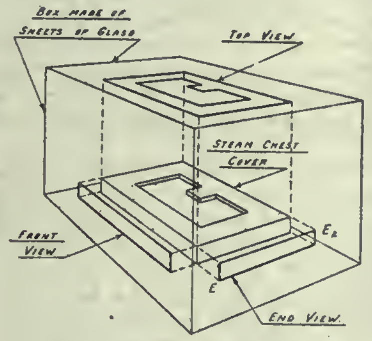


FIG. 5—THE STEAM CHEST COVER IN A GLASS BOX ON THE SIDES OF WHICH IMAGES HAVE BEEN TRACED.

Three different views are, as shown in Fig. 7, usually necessary to define adequately the proportions of an object. The front view is sometimes called the front elevation or vertical projection because it is a reproduction of the projection of the object on a vertical plane. The top view is also sometimes called the plan or the horizontal projection. The side view is sometimes called the side elevation or profile projection.

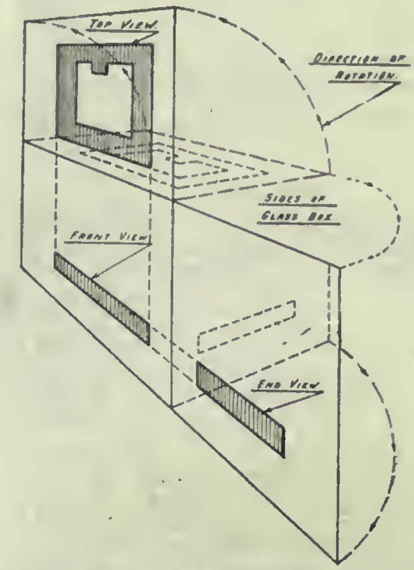


FIG. 6—HOW THE IMAGES TRACED ON THE SIDES OF THE GLASS BOX MAY BE ROTATED SO THAT THEY ALL LIE IN THE SAME PLANE.

How planes, edges, and corners are represented in orthographic drawings will for the most part, be evident from a consideration of what has preceded. Thus it is true that in an orthographic drawing, an edge is always represented by a line. If it is assumed that the line of vision of the observer is at right angles

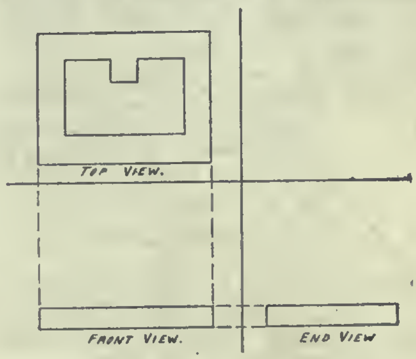


FIG. 7—ORTHOGRAPHIC DRAWING OF THE STEAM CHEST COVER TRACED FROM THE IMAGES OF THE GLASS PLANES OF FIG. 6.

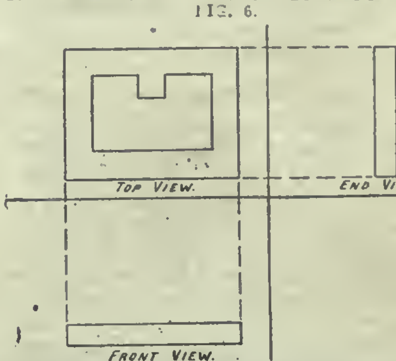


FIG. 8—ORTHOGRAPHIC DRAWING OF THE STEAM CHEST COVER REARRANGED SO AS TO CONFORM TO STANDARD USAGE.

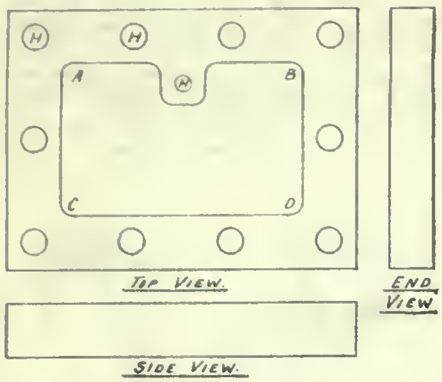


FIG. 9—ORTHOGRAPHIC DRAWING WITH THE DIFFERENT VIEWS BROUGHT TOGETHER BUT WITHOUT DOTTED LINES TO INDICATE HIDDEN SURFACES AND INTERSECTIONS.

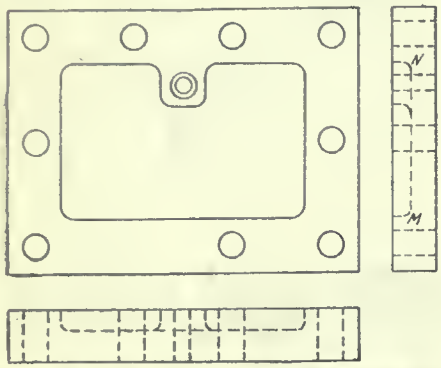


FIG. 10—PARTIALLY COMPLETED ORTHOGRAPHIC WORKING DRAWING OF THE STEAM CHEST COVER

to the line, then the line will be shown in its true length. A straight edge or surface viewed at its end appears on the drawing as a point. A corner of the object always appears on the drawing as a point regardless of the direction from which it is viewed.

Invisible or hidden surfaces or edges are, when observed side on, represented

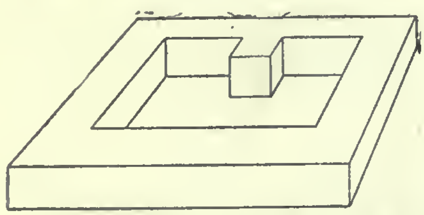


FIG. 11—HOLLOW BLOCK WITH INTERNALLY PROJECTING LUG.

in the orthographic drawing by dotted lines. No dotted lines are shown in Fig. 7. How they should be introduced will be treated later.

Arrangement of Views

In arranging the views in an orthographic drawing it is usually customary to place the top view in the upper left-hand corner of the sheet, front view below it, and the end view at its right, as shown in Fig. 8. This is ordinarily the preferable practice as it allows space in the lower right-hand corner of the sheet for the title. However, there is no reason why one of the other possible arrangement should not be followed, provided the ideas of orthographic projection are used consistently. Thus,

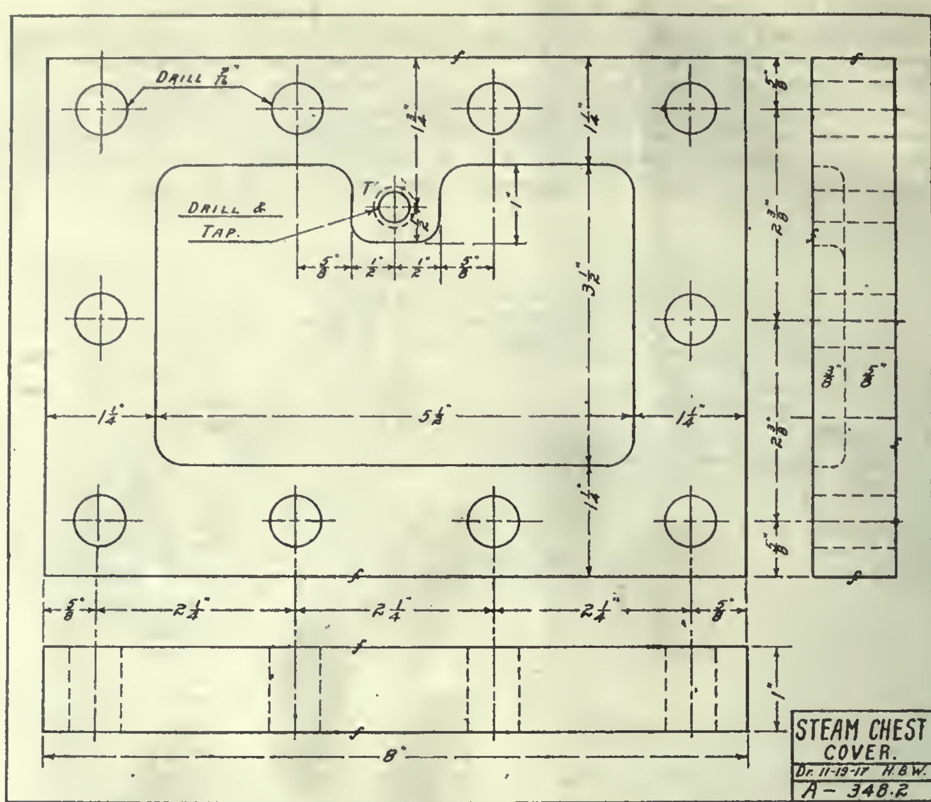


FIG. 12—THE COMPLETED WORKING DRAWING OF THE STEAM CHEST COVER.

Fig. 7 shows a perfect reproduction of the steam chest cover. It may at times be desirable to show above its plan view a rear view of the object and in addition a right-end view and a left-end view. Or it may serve more satisfactorily to show a left-end view without a right-end view.

To complete the orthographic drawing of the steam chest cover shown in Fig. 8 into a finished product, the first step would be to move the views closer together, which would result in the plot detailed in Fig. 9. Also the bolt holes, H, which have been omitted from Figs. 2 to 8, inclusive, to insure simplicity, should be included. Next, the dotted lines representing invisible surfaces should be incorporated. The resulting sheet will then appear as in Fig. 10. The importance of the dotted lines is apparent when one considers that unless these are shown one would not be able to learn from the drawing (Fig. 9) whether the depression ABCD extended entirely through the block as shown in Fig. 11 or only partially through, as shown in Fig. 1 and specified by the dotted line MN in Fig. 10. Finally to complete the drawing (Fig. 12) add the center lines, dimensions, dimension lines, arrow heads and title. Note (Fig. 12) how screw threads for the tapped hole T are indicated.

Number of Views Required

The number of views necessary to definitely describe the object in the picture language of orthographic drawing is a thing which must be determined for each case on its merits. For example, occasionally, as illustrated in the anchor-bolt example of Fig. 13, one view with appended notes transmits all of the data that is necessary. It is seldom, however, that one view of an object defines it sufficiently. If one considers that the general contour of the top views of the objects of Figs. 1, 11 and 16 would be precisely the same, the importance of this feature is apparent. A side or a front view would be necessary to show the difference in contours of the objects of Figs. 1 and 16. How the construction of Fig. 11 is shown by dotted lines to be different from that of Fig. 1 has been explained in connection with the discussion of Fig. 12. Certain objects, such as the cylindrical spacer of Fig. 14, can be shown, so that there is no possibility of misunderstanding their contour, with two views.

Another example of a two-view drawing is that diagrammed in Fig. 15, which shows the perspective view and the orthographic projections of a cast iron channel washer or plate which may be used for clamping shaft hangers or similar devices to a twin-channel girder

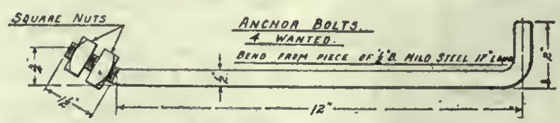


FIG. 13—AN ANCHOR BOLT. EXAMPLE OF AN ISOMETRIC DRAWING IN WHICH ONE VIEW TELLS THE WHOLE STORY.

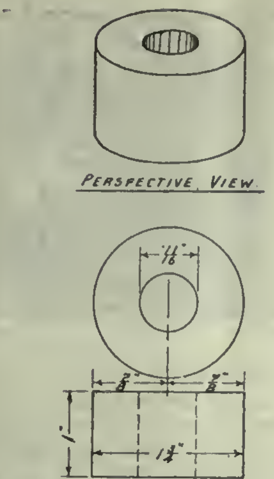


FIG. 14—PLAN, ELEVATION AND PERSPECTIVE VIEW OF CYLINDRICAL SPACER.

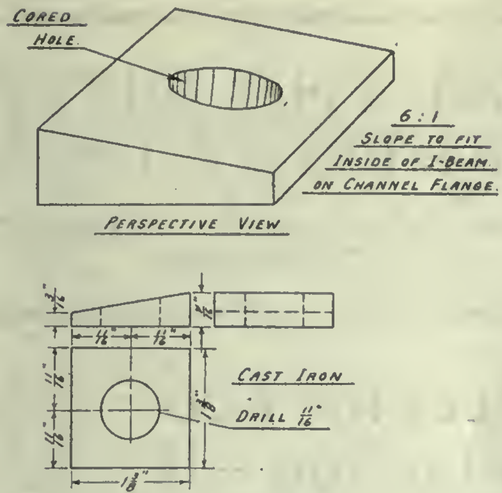


FIG. 17—CHANNEL OR "I" BEAM FLANGE WASHER.

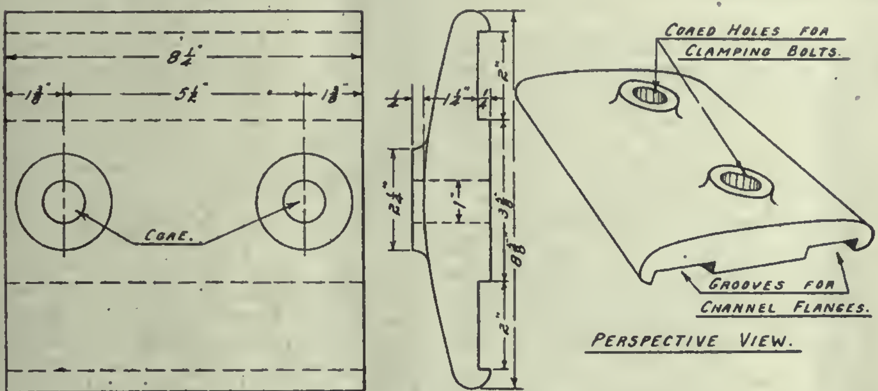


FIG. 15—DETAILS OF CHANNEL PLATE, CAST IRON.

or roof truss. An object necessitating three views for its perfect definition is the flange washer described in Fig. 17.

Isometric Example

An example of a three-view isometric drawing is given in Fig. 18 which shows the proportions of a casting which has been utilized very effectively in certain industrial shops and plants for supporting overhead motors and shaft hangers. These beams, for such they are, are clamped between two twin-channel girders which are erected for their reception. The construction thus provided is fireproof and very substantial.

Sometimes sections are used in combination with orthographic views to indicate the construction of an object. Fig. 19, which shows a cable or pipe-rack casting which is designed to hook over a bolt inserted through a web of a steel tee, constitutes a good illustration of this practice. The general subject of sectional reproduction and section lines will be treated in a future article.

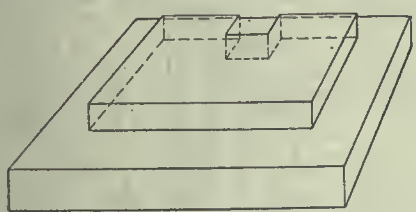


FIG. 16—RECTANGULAR BLOCK WITH EXTENSION PROJECTING FROM UPPER FACE.

LIQUID FUEL APPLICATIONS

According to one of the large oil companies, liquid fuel is to be found giving highly efficient service in bakeries, breweries, brass and other foundries, bedstead factories, bolt and nut works, boiler shops, cement works, cycle works, chemical works, dyers' works, drop-forging works, dynamite works, distilleries, engine works, elecricity generating stations, glass works, pottery works, railway works, steel rolling mills, sugar refineries, shipyards, tube works, tool works, tramway undertakings, waterworks, wagon works, and wire works. Amongst more or less unfamiliar processes in which it is used are tempering magnets, drying tea, smelting tin and ore, shrinking tires, soldering, heating rivets, distilling petroleum, bending plates, heating buildings, galvanizing, dust destruction, carbonizing lamp filaments, and singeing cloth. It is also used in many metallurgical processes in addition to those mentioned.

To face a cast-iron pulley with leather apply acetic acid to the face of the pulley with a brush, which will roughen it by rusting, and then when dry apply a cement made of one pound of fish glue and one half pound of common glue, melted in a mixture of alcohol and water. The leather should then be placed on the pulley and dried under pressure.

The fire point of an oil is the lowest temperature at which the oil itself ignites from its vapors when a small test flame is quickly approached near its surface and quickly removed. Since the fire point is always above the flash point the fire point value becomes of minor importance for this paper.

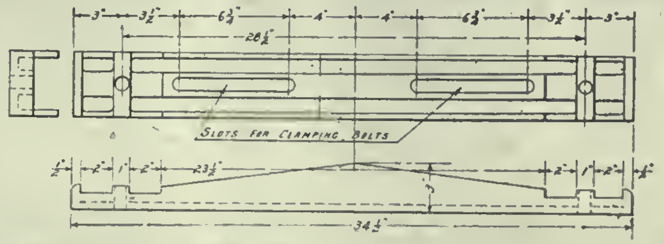


FIG. 18—CAST IRON MOTOR OR SHAFT HANGER SUPPORT TO SPAN ACROSS TWO CHANNEL GIRDER (THIS IS AN EXAMPLE OF AN ISOMETRIC DAAWING FOR WHICH THREE VIEWS ARE NECESSARY.

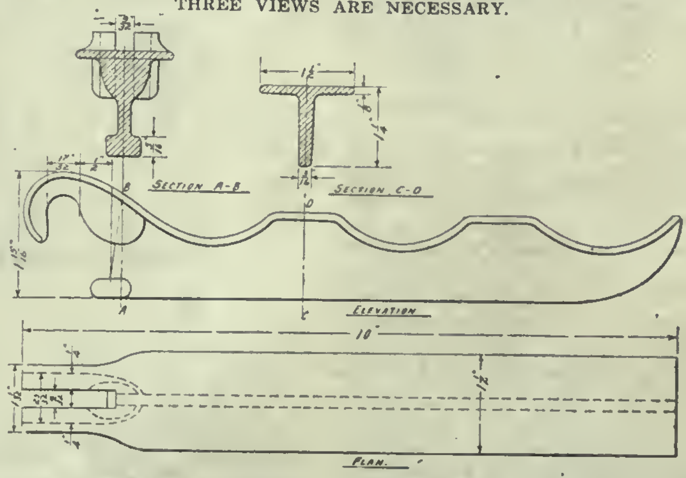


FIG. 19—CABLE OR PIPE RACK DETAILS. THIS SHOWS HOW SECTIONAL VIEWS MAY BE USED IN COMBINATION WITH ORTHOPEDIC PROJECTIONS TO CONVEY THE REQUIRED INFORMATION.

FROM THE MEN WHO PRODUCE

Methods, Machining Devices, Systems and Suggestions From Shop And Drafting Room

Efficient Appliances for Economic Shell Production—II

By J. H. RODGERS
Associate Editor Canadian Machinery

Radius Grinding Cutter.

While the production of the 18 pdr. has been discontinued here in Canada many devices were developed for the rapid and economic manufacture of this size of high explosive shell. A very interesting and serviceable device for the grinding of the boring cutters is illustrated in Fig. 9, and as this attachment could be easily applied to almost any make of small grinding machine, the same principle might very well be adapted to many other lines of similar work. The appliance consists of a base A that can be secured to the table of the machine. The upper portion of this base is fitted with a slide in which is placed the rest B, the top surface of which is inclined at an angle of about 6 degrees for grinding the clearance on the cutters that are held in a specially designed block E, which is provided with pivot hole so located as to revolve on the pin G to form the radius on either side of the cutter, the block being reversed to perform the operation on the opposite side. The cutters are held in position by means of the screw F.

Stops H and I are provided at the desired positions to regulate the travel of the block from one position to another, and also act as a guide when grinding the straight portion on the face or the side. Close adjustment is obtained by the screw J and locking nut K.

Unique Grinder For Shell Bore

It is seldom that the bore of the shells is sufficiently smooth after the finish tooling has been performed, and for this reason, and likewise to conform to the specifications it is necessary that some method be adopted to put a finish on the bore that will meet the requirement of the contract and pass the examination of the inspectors. The method generally adopted for this purpose has been to grind out the irregularities by some simple device constructed for the work. Many different appliances have been developed for smoothing the surface and nearly all of them have particular advantages that have kept them in continual service. As has been the case in all other impromptu appliances the available material about a plant has been the chief reason for the wide variance in the design of this and similar wheel E, a thrust ring F being fitted to the forward end of the shaft I which is supported in the long babbited tubing K, the latter being securely held in the casting L. A dust cap M is located on the forward end of the chuck. The grinding wheel H is fitted to the end of the shaft I which is supported in the equipment.

The device shown in Fig. 10 may appear quite complicated but it has proved very efficient and is of special interest owing to its unique construction and its method of operation. The supporting frame is made from two S shaped structural members held in position by the channel irons shown. Two solid steady rests are secured on one end that carry the large collet chuck D that is operated by means of the hand long babbited tubing K, the latter being securely held in the casting L. A dust cap M is located on the forward end of the tube to prevent the dust from destroying the bearing. A piece of cold rolled shafting is secured in the middle of this casting L, which acts as a plunger in the cylinders T T, one of these being located at either end of the machine and supported in suitable brackets—not shown. The adjustment of the cutting wheel is obtained by means of the nut Q that is fitted to a rod P connected to the bracket at the point O. The fixture is so arranged on the shaft R that by a simple movement the support together with the grinding shaft, can be swung aside to remove the shell from the chuck. The longitudinal feed for the grinding wheel is obtained by a combination of compressed air and oil, the latter being contained in a couple of spoiled 8 inch shells and so connected that the air supply coming through the pipe 2 is supplied at will to either cylinder by the control of the three-way

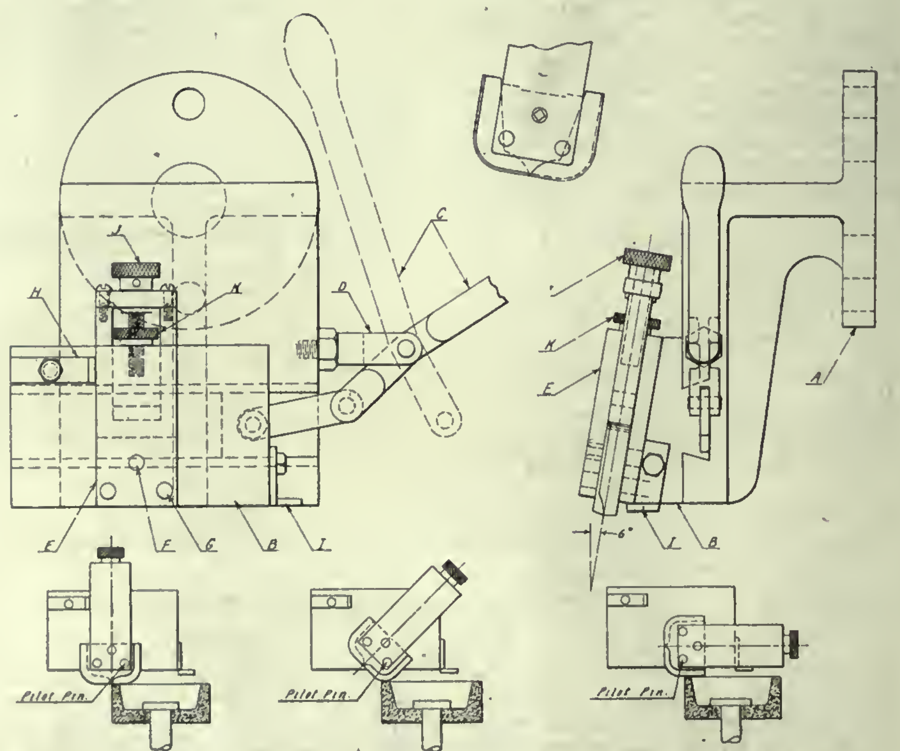


FIG. 9 RADIUS GRINDING FIXTURE 18 PDR. H.E. SHELLS.

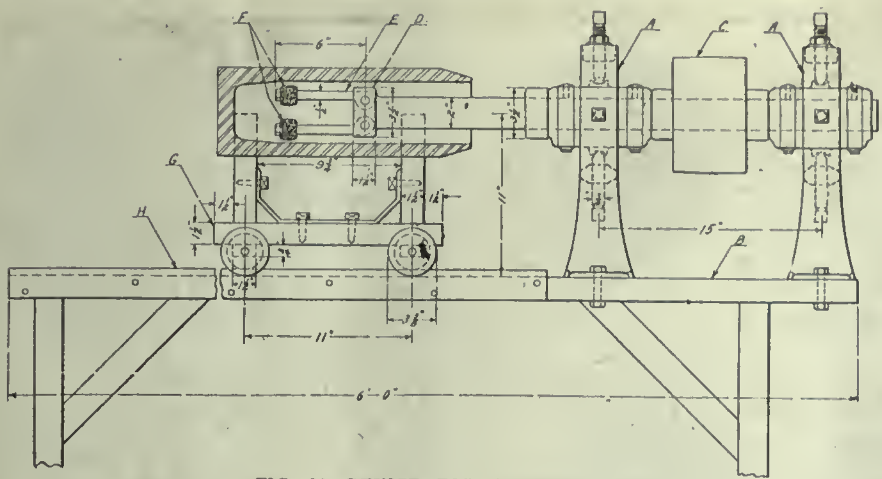


FIG. 10—DEVICE FOR GRINDING BORE.

cocks 4, 4, these being so connected that they operate in unison. As the air passes through the pipes 5 and into the upper portion of the shell reservoir, the oil is forced up the pipes U and against the cold rolled shaft plunger. The speed of the movement can be regulated by adjusting the valve V whereby the flow can be adjusted to suit the desired conditions. This appliance while rather cumbersome has nevertheless given very good results.

Another Method For Grinding Bore

A somewhat simpler device designed for the same purpose is shown in Fig. 11. In this particular case the bearings for the grinding shaft is composed of two 11-inch hangers fitted to a suitable plank B, the shaft being operated by the pulley C. On the grinding end of the shaft is the piece D in which is supported the two arms E that carry the grinding wheels F; these are circular in shape and held in position by the small nuts shown. To renew the cutting properties of the wheels it is simply necessary to slacken the nuts and give wheels a slight turn. The carriage is composed of a wooden framework mounted on two small trucks that run in a parallel direction to the grinding spindle on the track H. It is very advisable that the axis of the shell when resting on the carriage should be central with the inner shaft, as any eccentricity would tend to destroy the regular operation of the fixture.

Three-Piece Boring Cutter

Boring bars are numerous in design but the general principal is invariably the same. In the one here shown in Fig. 12 the cutter is made in three distinct pieces, the portion used to form the base of the shell and the profile being located in the end of the bar, while the parallel section of the bore is derived by the two side cutters. The reason for this design was the saving that was effected in the use of high speed steel, as smaller bars could be used in making the cutters. The side cutters can be adjusted by means of the two small headless screws E. The cutting lubricant is distributed to the side by two inclined holes leading off from the central hole.

Three-Bladed Cutter Head

A three-bladed cutter that has given excellent satisfaction is illustrated in Fig. 13. The cutter head A, which is made of machine steel or cold rolled, is fitted by means of a screw and taper, to the machine steel bar B which is held in position in the turret or back rest of the machine. Three equidistant slots are milled out in the head A to receive the three cutters C C and D, the last one having an extension on the forward end for facing purposes, a suitable slot being milled across the face for support to this cutter. These cutters are secured in position by means of wedge blocks E and fillister screws F. The use of the three cutter method has a stiffening tendency and assists in steadying the cutter when in operation.

Finishing Inside Profile.

Following the nosing operation of the shells and for the same reason explained in a previous section of this article, it is necessary that any "irregularities in the interior, resulting from the bottling operation, should be removed before the shell can be accepted by the inspectors. Owing to the confined space that is now left for machining of any kind it becomes a difficult proposition to accomplish this purpose, particularly if the irregularities on the inner profile are very pronounced. The small opening left in the nose of the shell prevents the use of a boring bar that will be stiff enough to do any serious amount of machining, so that the bars that have been developed for this purpose are generally of a character that great care requires to be exercised in their operation. The one shown in Fig. 14 is similar to that used in a large number of plants, this being comprised of a solid bar so shaped as to give the maximum rigidity under the conditions present. In order to obtain the maximum holding power for the screws they are placed near the center of the bar, and for this reason the back edge of the cutter is provided with three slots through which the screws pass. The outer end of the bent bar is turned to receive the small roller shown that serves as a guide for the finishing position of the cutter, preventing the same from cutting below the point intended. Lubricant is forced to the cutter through the center of the bar and out through the inclined opening. In using these cutters it is necessary that the shank be removed from the support before the bar can be removed from the shell.

Special Inside Profiling Device.

A very interesting profiling device was developed by the engineers of a large plant for cleaning out the shell after the nose has been closed. The main body A of the fixture is made from a steel forging, the shank turned to fit the hole of a turret and additionally supported by means of the keyway B. The cutting tool C is contained in the slot cut in the center of the bar extension and is pivoted by the stud D, the outer end of the cutter swinging through a small arc and being a working fit at the point E. The device is operated by the handle F which is secured to the sleeve G threaded in the boss on the main holder. Through the center of the sleeve is fitted the bolt I, the ball head of which bears against the tail of the cutter. This tail is maintained against the head J by the action

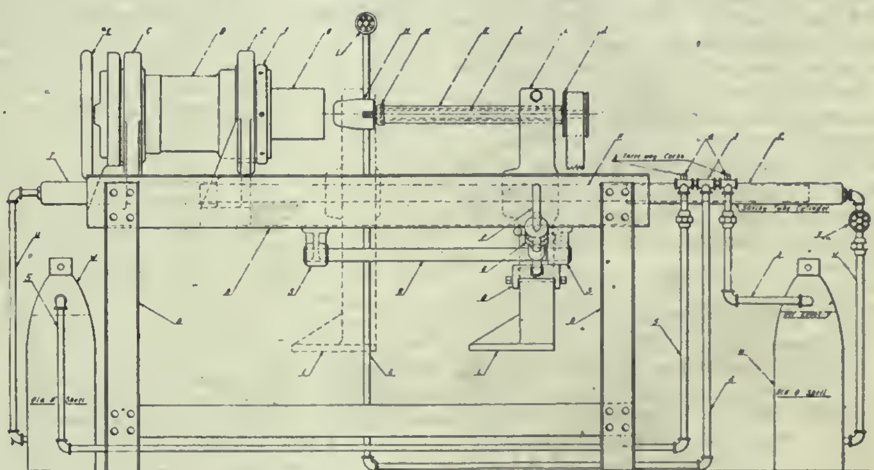


FIG. 11. GRINDING BORE OF 6-IN. SHELL.

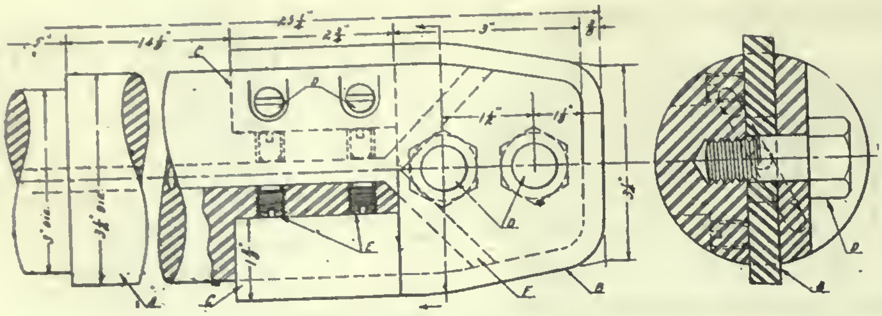


FIG. 12—BORING BAR HEAD

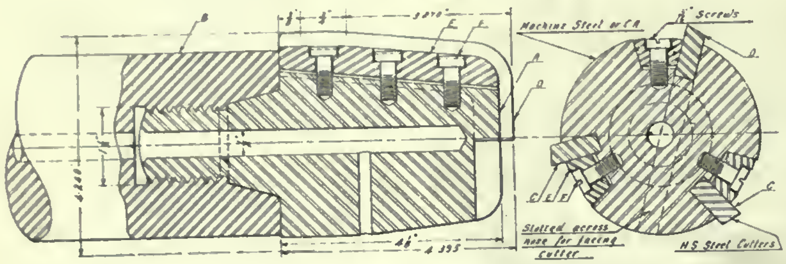


FIG. 13—FINISH BORING BAR.

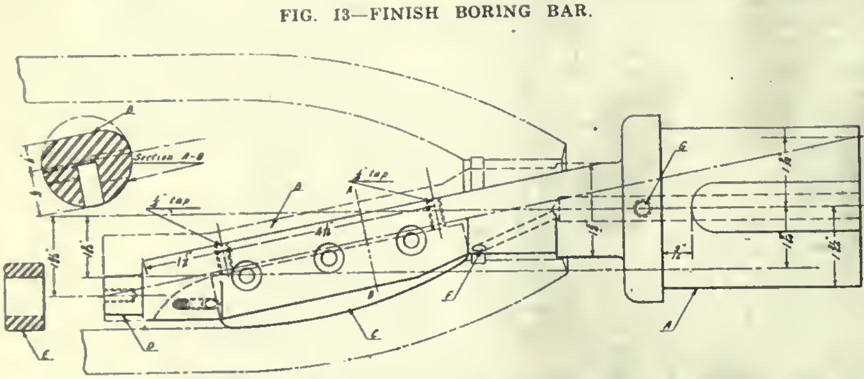


FIG. 14—INTERNAL PROFILING TOOL. WATEROUS ENGINE WORKS.

of the spring P against the nut M which is locked on the screw K, which in turn passes through the sliding piece L. The adjustable screw N serves as a positive stop when the desired position of the cutter is attained. The retainer O is securely bolted to the main holder by means of the bolts Q. A small groove R in the forward end of the cutter allows the cutter to come back against the stop S, and when in this position the cutter is practically in the center of the bar, leaving the same free to be removed from the shell without removing the holder from its fixed position.

GEOTHERMIC STEAM GENERATION

The remarkable achievement of successfully utilizing underground volcanic heat for the generation of power in the neighborhood of Lardarello, Central Tuscany, Italy, naturally suggests the possibility of applying the same method in other localities. Such utilization of the internal heat of the earth, however, is dependent upon exceptional physical conditions, and it has occurred to an American engineer, Mr. Nathaniel B B. Wales, that these conditions could be produced artificially. The increase in temperature of the earth's strata in proportion to its depth shows a mean average for the entire earth surface of one degree Fahr. for every 55 feet of depth. There are many regions, however, where this increase in temperature is far exceeded. Hundreds of areas are to be found in the United States where the temperature rises one degree for every 20 or 25 feet of depth. There is a locality near Boise, Idaho, where three wells driven to only 400 feet yield 800,000 gallons of water daily at a temperature of 170°.

It is Mr. Wales's plan to sink a well-casing wherever the geothermic condition are favorable until a stratum of high temperature, say 350° to 450° Fahr. or higher is penetrated. Surrounding this shaft a number of other casings would be sunk. Water would be injected into the heated stratum through the central well-casing, and the head of the water would cause it to percolate through the surrounding strata, from which it would absorb heat and be converted into steam. The steam would then rise through the circle of well-casings surrounding the central water shaft, and could be employed for power or heat. In this way a large zone embracing several acres could be utilized to form the active heating surface, drawing heat through the contiguous rock from an enormous radiant rock contract and allowing an inflow of heat from millions of tons of the earth's mass. The permanence of such an evaporative surface is amply proved by the maintenance of hot artesian wells, which are to be found throughout the world.

There are many areas in this country where borings not over 5,000 feet would give the necessary temperature, and others of 1,500 feet or less would supply all the heat required. In some places thesteam generated might have to be used indirectly because of the earth salts held in suspension; but no doubt these salts could very profitably be recovered and would add to the value of the instillation.—Jour. Frank. Inst.

BUREAU FOR INVENTORS AT WASHINGTON NOW

The following statement is autthorized by the War Department:

In order to secure prompt and thorough investigation of inventions submitted to the War Department an "Inventtions Section" has been created as an agency within the General Staff. All inventions of a mechanical, electrical, or chemical nature submitted to the War Department for inspection, test, or sale are now considered by this section.

May be Sent by Mail

Inventions may be sent by mail or may

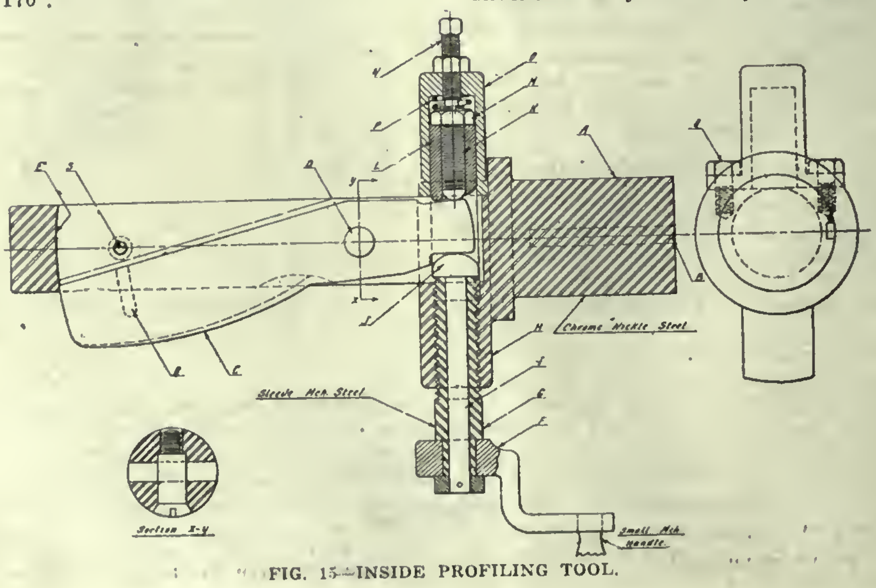


FIG. 15—INSIDE PROFILING TOOL.

be submitted in person, accompanied by written descriptions or drawings. They go first to an examining board having technical knowledge of the classes of inventions they handle, whose investigations determine whether the inventions have merit. Those with merit are referred to the Advisory Board, which determines in each case whether it should be put in the hand of some of the numerous testing and developing agencies, or if it should go to one of the staff or supply departments for test and consideration of its adoption, and final acquirement of title if such action is desirable.

When completed the board will have 12 to 15 members to cover fully all of the various technical problems which may come before it.

Assisted by Agencies

In testing and developing inventions and in considering problems presented by staff departments, the Advisory Board works in connection with a number of agencies. Among them are the following: Research Council; Bureau of Standards; War Committee of National Technical Societies (this committee consists of two members detatiled from each of the 10 important technical societies in the United States); laboratories and shops of the staff and supply departments of the Army; Patent Office; Aircraft Production Board; all Army Service Schools; C. L. Norton, Massachusetts Institute of Technology, Cambridge, Mass.; Dr. Charles P. Steinmetz, General lectrical Co., Schenectady, N.Y., etc.

Information for Inventors

Any person desiring to submit an invention for consideration, test, sale, or development should do so by letter, giving in order the following information: Name and object of the invention; any claim for superiority or novelty; any results obtained by actual experiment; whether the invention is patented; whether remuneration is expected; whether the invention has been before any other agency; whether the writer is owner or agent; the number of inclosures with the letter. A written description and sketches or drawings of sufficient detail to afford a full understanding of the cases should also be submitted. Should the invention be an explosive or other chemical combination, the ingredients and processes of mixture should be stated.

The Inventions Section will not bear the expense of preparation of drawings and descriptions, nor advance funds for personal or traveling expenses of inventors.

All Matter Confidential

Any matter submitted will be treated as confidential. The inventor will be notified of each step taken during the investigation of his invention. All communications should be addressed: Inventions Section, General Staff, Army War College, Washington, D.C.

AT ONE TIME ALL THE FILES IN USE WERE TURNED OUT BY HAND

THE MANUFACTURE OF FILES

By Mark Meredith.

For many years files were made entirely by hand, and at the present time the best files are still made in that manner. The file may be called a metal-cutting or abrasion tool, and it removes the metal by means of a series of sharp-edged parallel ridges, all inclined at an angle of about 50 degrees to the axis of the tool. There are numerous types of file differing in fineness of cut, and these are all divided into two broad classes of "double cut" and "float cut," or a "single cut." The former have two rows of cutting edges equally inclined to the axis and the latter have only one. In preparing the files steel blanks are first forged which have been previously sheared or rolled to the section required for the tool. This blank is, of course, of soft steel, and it is held on the anvil by means of a strap which passes round the tang and is held down by the foot of the operator. If the underside has been cut already, or is not flat, it is protected from damage by interposing lead or pewter as a soft support.

Then, using a chisel which is rather wider than the blank, the operator makes a series of cuts parallel to each other and at the proper angle. The hammer is chosen with great care to be of such a mass as to cause the burr from each cut to rise to the right height. The distance of one cut from the next is gauged by resting the inclined chisel against the last burr when cutting the next. By increasing the slope of the chisel the distance apart of the burr is increased and vice-versa. It is obvious that the greatest skill and practice is required to strike the chisel with the right force, and to keep its inclination constant over many hundreds of cuts. The height of the burrs as well as their distance from each other governs the fineness or coarseness of the cut. In the ordinary double-cut flat file there are 6 degrees of fineness respectively, called rough, middle, bastard, second cut, smooth, and dead smooth. Float-cut files are made in the rough, bastard and smooth varieties. In making double-cut files the first series of cuts are smoothed over very slightly before making the second series. Lancashire used to make the best files, and even now no place can compete with it for the finest files, such as watchmakers use. There is a file that has been made in Lancashire on which there were 300 cuts to the inch.

The rasp cuts in virtue of a number of triangular shaped projecting burs distributed over its surface. These are made with a three-cornered pointed punch or chisel. They are distributed as evenly as possible, the great object of the file-cutter being to arrange that one cut shall not come behind the other. There is thus great skill in arranging by the eye a pattern in which the number of cuts per square inch shall be uniform and yet in which they are rightly and irregularly placed relative to the axis of the tool.

Rasps, again, are made in rough, bastard and smooth cuts.

The wide use of aluminum has brought into use files of the "dreadnought" type. In these the cut is single and is normal to the axis, or nearly so. It is very coarse and the teeth are deep and triangular in section. As a rule they are not straight, but are shaped in arcs or circles arranged parallel to each other. This coarse type of file is necessary because the aluminum being soft rapidly clogs the teeth of the ordinary file, making the edges so that they will not cut. For the purpose of filing up metal patterns, often on awkward concave surfaces it is best to take old files, and having softened them, to cut straight dreadnought type teeth on them with a three-cornered file. The files are then bent to suit the cavities and corners which have to be worked, and are rehardened by heating and plunging into oil. In this way a most ingenious set of tools can be made to perform all sorts of impossible jobs with ease and accuracy.

Returning to the orthodox file cut in the soft steel blank, the next operation is to straighten the file out accurately. It is then hardened, the teeth being protected from burning in the heating process. After hardening the quality of the cut is improved by exposure to a blast of fine sand.

Numerous attempts have been made even in the eighteenth century to devise machines to replace the hand file-maker. These all attempted to imitate his action by means of an arm carrying a chisel, the latter being struck by a hammer, which is operated mechanically. The successful machines of the present day carry the blank on a table which advances very slowly under a chisel or hammer which reciprocates rapidly. By varying the rate of the transverse of the table the coarseness of the cut can be altered. But it still remains a fact that the hand-operator can make the best file, and this is attributed curiously enough to the advantage of a certain amount of irregularity in the teeth of the hand-cut file which it is very difficult, if not impossible, for the machine to imitate.

"Dear Clāra," wrote the young man, "pardon me, but I'm getting so forgetful. I proposed to you last night, but really forgot whether you said yes or nor."

"Dear Will," she replied by note, "so glad to hear from you. I know I said 'No' to someone last night, but I had forgotten just who it was."

In response to many inquiries from private persons as to the desirability of saving and selling old tin cans, the Department of Agriculture says it has been told by a detinning company that cans free from rust and foreign matter are worth $12 a ton, f.o.b. factory. It takes from 7,000 to 8,000 cans to weigh a ton, and the company says it is not advisable to collect the cans except in large towns.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

THE "ALL-ANGLE" GRINDERS BROUGHT OUT AND MADE IN TORONTO FACTORY

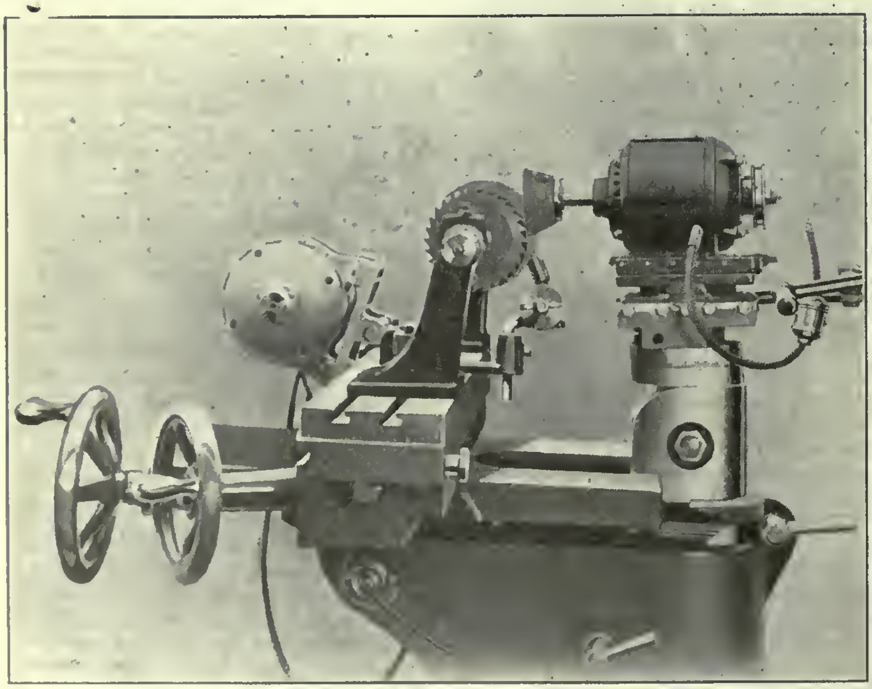
The "All-Angle" universal grinder which has been perfected by W. J. Rennie, superintendent of the Toronto Type Foundry Co., Toronto, and is being built by this concern, is a new tool embodying a number of interesting features. The outstanding feature is the large variety of work that can be done on this grinder without extra attachments. All angles and tapers can be got by adjusting the grinding head and there is no necessity for using internal, cylindrical or universal attachments, thereby eliminating a large tool cupboard and also effecting a great saving in time in setting up the grinder for working. This grinder can be placed in any position in the toolroom as no belts or countershaft are necessary. The machine has independent motors which can be run on a lighting circuit. The accompanying illustrations show the general design of the grinder and location of attachments for certain classes of work. The grinding head is graduated to obtain any required angle in vertical or horizontal positions and by this means extremely accurate work can be obtained.

The grinding head consists of a motor mounted on a sliding fixture which can swivel on the drop head. The drop head is constructed so that it can be turned round to any angle as shown on the graduated scale or can be dropped down, or tilted over also to any angle as shown on another graduated scale at the back. The motor spindle which runs at 10,000 r.p.m. carries at the front end an external grinding wheel, while at the back end of spindle is a "C" attachment for surface or large internal grinding; mounted on top of the motor is a bracket carrying a belt-driven spindle running at 30,000 r.p.m. This carries an "A" attachment for small diameters. The bent crank operates the sliding fixture to adjust the grinding head in position and there is also a screw for fine feed. The drop head can be locked in any position.

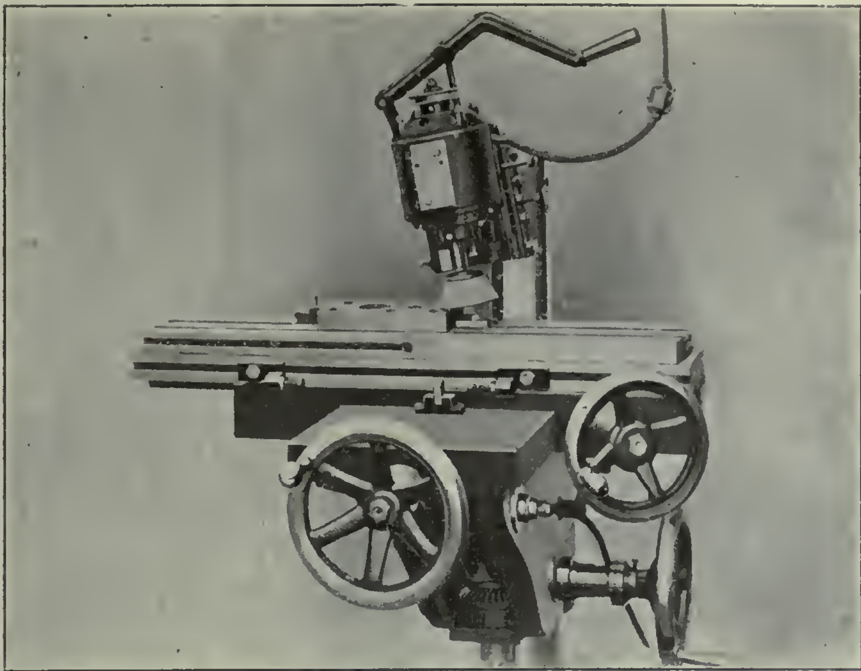
The table is in two parts, upper and lower. The lower part works in slides while the upper works on a pivot and can be set at any angle up to 10 degrees from zero either way; the angle being noted from the graduated scale at one end. The table is traversed by means of the upper hand wheel at the side and is provided with stops at the front fastened in a groove. The hand wheel has a graduated scale. The drive head can be equipped with a drive plate or chuck, or used as a headstock. When used as a drive head, it is driven by a motor attached to the table. Both drive head and motor are equipped with S K F ball bearings. The table also has a tailstock for certain operations. The centres will allow for a swing of 11 inches. The in and out motions of the table are operated by the hand wheel at the front. This wheel has a graduated scale for feed control. A useful attachment is the universal finger or tool rest. This attachment can be set in any position and at any angle.

The knee upon which the table os mounted can beswung around to any angle, the pillar having a graduated scale for noting the angle. The knee is operated in a vertical direction by means of a telescopic screw, by bevel gearing. The type of screw provides for a longer range of travel without measuring the height of the machine. The screw operating gear has ball bearings. The knee is operated by the lower hand wheel on the left side. The base of the grinder is box section and has four plugs, one at each corner for the motor connections.

For external grinding the work is held on an arbor or drive plate and the grinding wheel placed in any required angle or position. The machine is particularly well adapted for grinding steel profile gauges for shells owing to the peculiar form of the gauge and great accuracy required. For this work the former and work are held on an angle plate attached to the table and the grinding head placed in a horizontal posi-



GRINDING A MILLING CUTTER, HELD ON AN ARBOR. THE GRINDING HEAD IS TILTED TO OBTAIN CLEARANCE, THE EXACT CLEARANCE BEING SHOWN ON A GRADUATED SCALE.



GRINDING FACE OF A STEEL DIE. THE GRINDING HEAD IS SET OVER INTO THE VERTICAL POSITION TO NINETY DEGREES. THE MOTOR IS THEN TILTED TEN DEGREES TO GIVE A CONCAVE SURFACE TO THE DIE.

tion. The slide is left free to allow the former to raise and lower the grinding head. When grinding blanking dies, the table is set at zero, and the grinding head is set over into the vertical position to 90 degrees. The motor is tilted to give a concave surface to the die.

For internal grinding the work is held in a chuck or bolted to the drive plate. The grinding head is used in a horizontal position and turned round so that either the "C" or "A" attachments can be used, according to the diameter of hole to be ground.

The following specification gives some of the principal dimensions and features of the "All-Angle" grinder. The grinding motor is of the universal type built in any voltage from 80 to 300. The main spindle speed is 10,000 r.p.m., which is the same for the "C" attachment for internal and surface grinding. The speed of the "A" attachment for internal grinding of small diameters is 30,000 r.p.m. The driving motor is a variable speed universal ball bearing motor with controller for 20 speed variations. The controller is attached to the knee under the table.

Longitudinal movement of table, 18½ inches.

Cross movement of table, 7 inches.

Vertical movement of table below the grinding wheel centre, 19 inches.

Surface grinding vertical movement with grinding head in vertical position, 5½ inches.

Will take work 15 inches long and swing 11¾ inches.

Surface dimensions of table, 28 x 5½ inches

Internal grinding, either straight or taper, from 5/16 to 10 inches in diameter and up to 6 inches in depth.

The table swings around the column through 360 degrees.

The grinding motor swings through a vertical plane of 90 degrees.

The grinding motor will slide in a plane parallel to its base to a depth of 5¾ inches, operated by feed lever.

The grinding motor, swivel base, and sliding base can be revolved 360 degrees. The grinding motor will revolve through 360 degrees in a plane parallel to and above the sliding base.

Floor space, 48 inches by 54 inches.

Net weight, 875 pounds.

Shipping weight, domestic, 1,000 pounds. Shipping weight, foreign, 1,250 pounds.

Shipping measurements, domestic, 5 feet by 2 feet 10 inches by 3 feet.

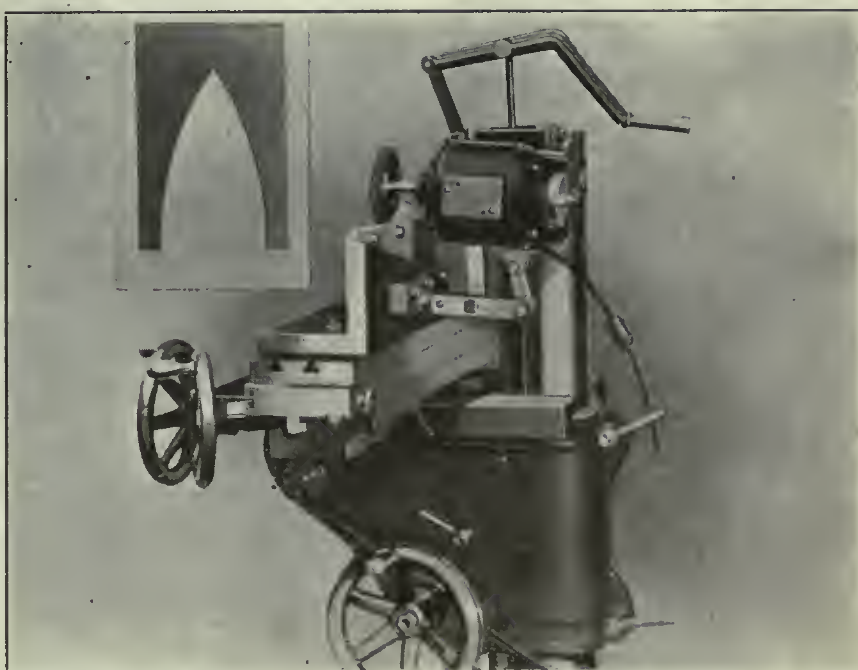
Shipping measurements, foreign, 4 feet 9 inches by 2 feet 4 inches by 3 feet 3 inches.

TRIPLE GEARED ENGINE LATHE

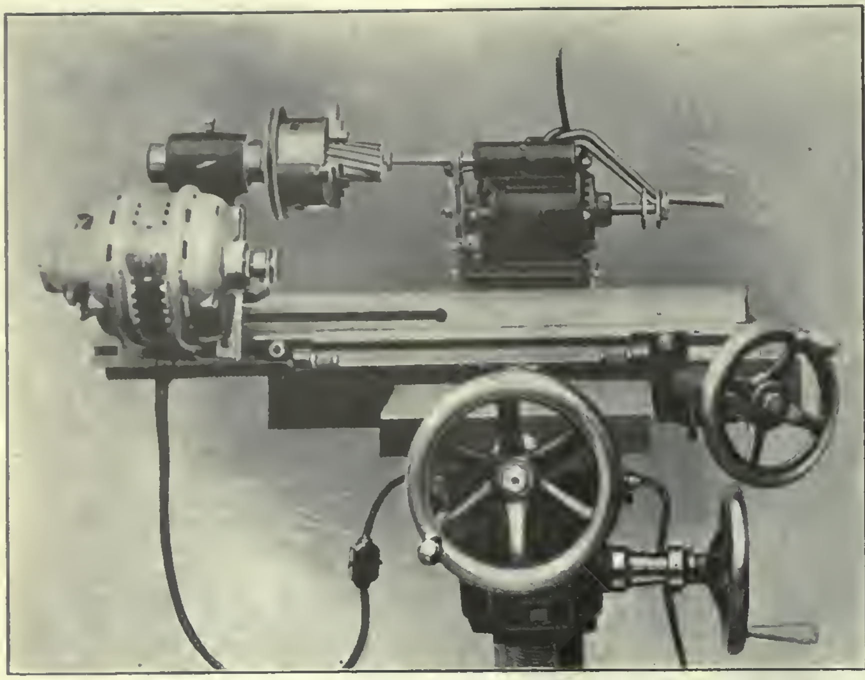
The triple geared engine lathe shown in the accompanying illustration, built by the Canada Machinery Corporation has been redesigned and improved. The lathe which is of strong construction is made in two sizes 36 in. and 42 in. swing.

It is equipped with four step cone and back geared drive and in addition with a triple geared drive direct to face plate. This arrangement combines great driving power and an ample number of spindle speeds. This lathe is a modern high speed tool of great strength and extreme accuracy. It is provided with a deep bed, giving maximum stiffness under cut. By means of feed box immediately below the headstock three changes may be instantly obtained. The saddle is substantial throughout with great strength in the bridge—the bridge having a bearing on the flat surface inside the V, in addition to the two V bearings. The machine in detail is as follows:

The bed is unusually deep and rigid, and is thoroughly braced with cross ribs of box section. It is provided with three inverted V's of liberal proportions. The headstock and the tailstock each rest on one V and one flat surface, and the saddle bears on two V's and also on the flat surface. The brackets attached



GRINDING ON SIDE OF A HARDENED STEEL PROFILE GAUGE FOR 4.5 H.E. SHELLS. NOTE THE POSITION OF THE FORMER AND WORK ON THE ANGLE PLATE. DUPLICATE GAUGES OF INNUMERABLE DESIGNS CAN THUS BE PRODUCED.



GRINDING THE HOLE IN A SPIRAL MILLING CUTTER. THE GRINDING HEAD IS SET OVER THE TABLE UNTIL THE "A" ATTACHMENT IS IN LINE WITH THE SPINDLE.

to the bed are made with a tongue fitting a groove in the bed, and the rack is securely screwed and dowelled to the bed.

Headstock throughout is unusually massive and is of the four-step cone triple geared to face plate type. It is equipped with split phosphor bronze bearings. The spindle is turned from our special high carbon spindle steel and has a hole bored from the solid throughout its entire length. It is accurately turned and carefully ground to size. The cone has four steps of extra wide faces to enable wide belts to be used, and in this particular we have more power in our lathes than found in other engine lathes of similar sizes. The saddle is large and rigid, having a bearing its full length on the V's. The apron is of the double walled type, there being a double bearing for all pinion studs. All gears in the apron are of steel. The handwheel is not geared directly to the rack on the bed but indirectly through a reducing intermediate gear to facilitate the movement of the saddle. When the lathe is used for screw cutting the rack pinion is drawn out of mesh by a knob handle on the end of the pinion stud.

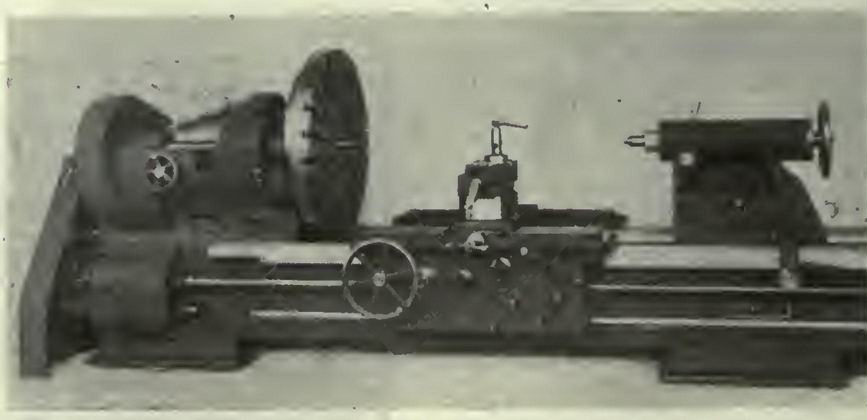
Three changes of feed are obtainable through the feed box on the bed below the headstock. By changing the gears on the head and quadrant plate any desired feed may be obtained. It is impossible to engage either the automatic cross or longitudinal feeds when the machine is set for screw cutting, or vice versa. The thread on the lead screw is used for screw cutting only. The feeds may be instantly reversed in the apron by a convenient lever. The saddle is securely clamped when using the cross feed. The lead screw is reversed for right and left hand threads by means of the reverse plate on the head. The feed gears in the head are arranged so that quick threads up to 8 in. lead can be cut by putting on gear to suit.

Thread chasing dial, for indicating correct point for engaging nut for thread cutting, is provided on the carriage, obviating the necessity for stopping the lathe when screw cutting. Micrometer adjustment is provided on the handles of the cross screw, graduated in 5/1000's and 1/32's of an inch. Compound tool rest is provided, with base graduated in degrees.

Tailstock is rigid and heavy, and is clamped to the bed by two bolts conveniently situated. It is also provided with a pawl engaging in a rack cast in the bed, which serves to take the heavy strain of the clamping bolts and gives a positive brace when the machine is engaged on heavy work. The pawl is operated by a rod convenient to the operator. The shape of the tailstock is such as to permit compound rest to be set at right angles without interfering. The spindle is graduated in inches and fractions of an inch for use in boring. The tailstock is adjustable across its base by means of a screw to permit of its being set over to turn taper, the base bebing graduated for this purpose.

Standard equipment includes countershaft with two friction pulleys, necessary shifters, follow rest, steady rest, face plate, change gears and necessary wrenches. Special attachments, such as taper attachment, turret on the bed, or saddle, turret tool post, etc., can be furnished at an extra price when so desired. Motor drive.—The lathes can, if so desired, be arranged to be driven direct by constant or variable speed motor, or by single pulley drive.

The distance between centres, 14 ft. bed, for the 36 in. lathe is 6 ft. 1 in., and for the 42 in. lathe 5 ft. 11 ins. The weight of machine complete with 14 ft. bed is 15,500 pounds and 17,000 pounds respectively. For both machines the width of belt on cone is 5½ in., steps on cone 4, number of speeds to spindle 24, diameter of front spindle bearing 6 in., and length 10 in., diameter of rear spindle bearing 5½ in., and length 7 in., diameter of hole through spindle 3⅛ in.



36 AND 42-INCH TRIPLE GEARED ENGINE LATHE

BEVEL GRINDER AND AUTOMATIC MILLING SAW SHARPENER

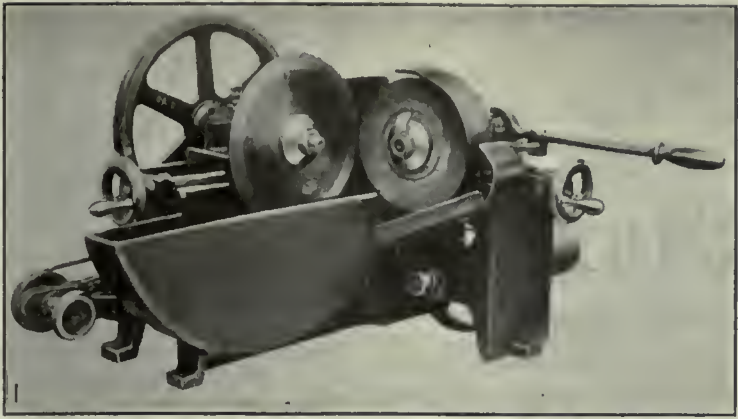
The accompanying illustrations show two machines recently marketed by the Machinery Company of America, Big Rapids, Mich. Figs. 1 and 2 show front and back views of the bevel grinder. This grinder is suitable for theg rinding or sharpening of circular cutters or knives commonly used on meat paper, cork cloth, etc., and will grind from within 10 inches of centre to within ¾ inch. Thus a cutter of 4 inches diameter may be bevel ground to a maximum width of 1¼ inch.

General Description

The operation of the machine is very simple and all adjustments will be readily understood. A hand adjustment is provided for a quick centering of the cutter, according to its diameter, for proper contact with the grinding wheel. A handwheel adjustment feeds the grinding wheel to or from the cutter, during the grinding process. A hand lever affords lateral movement of the grinding wheel across the surface of the cutter. The angle or degree of the bevel grind is adjustable to suit the requirements of cutters of different gauges, diameters, etc. The grinder is equipped with a water tank so that the grinding is done wet and tendency to heat and impair the cutter is avoided. An adjustable stop or back rest of fibre is mounted behind the cutter opposite the grinding wheel, which supports the cutter rigidly and prevents chatter or improper vibration. A guard is provided for the grinding wheel to prevent it throwing dust and water.

The grinding can be done very rapidly and satisfactorily, and if a cutter is but slightly dulled the time required for the grinding is negligible.

The machine is provided with every adjustment necessary to afford a bevel grind of any width up to 1½ inches on cutters not over twenty inches in diameter, and that sufficiently exceed a 3-inch minimum diameter to permit a bevel grind of required width.



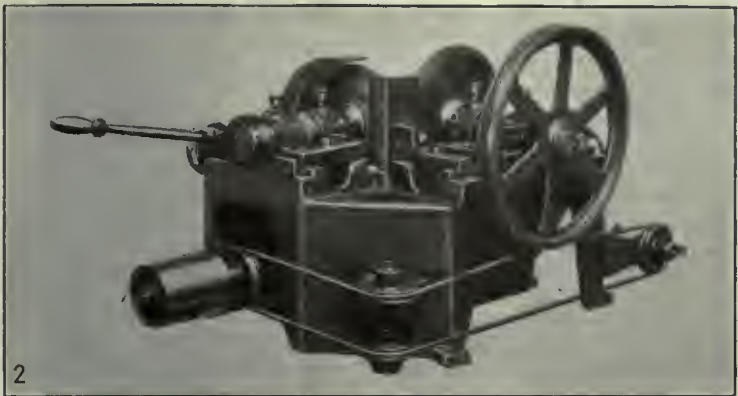


FIG. 1—FRONT VIEW OF BEVEL GRINDER. FIG. 2—BACK VIEW OF BEVEL GRINDER. FIG. 3—AUTOMATIC MILLING SAW SHARPENER.

The automatic slitting or milling saw sharpener shown in Fig. 3 was designed especially for regrinding and recutting slitting or milling saws 2 inches to 10 inches in diameter, usual spacing, and is especially well adapted to the reclaiming of very thing slitting saws with fine tooth spacings, which in the past on account of having no efficient means of re-sharpening have been discarded. With this grinder they may be resharpened repeatedly until the entire value is received from the blade.

Utility

The grinding of the teeth is absolutely uniform; the cutting points are kept perfectly "in spacing,' equalizing the strain on the saw, and keeping them always sharp and in perfect condition, insuring smooth, fast-cutting with reduced friction and heating of the blade in the cut. The action is full automatic, requiring very little attention on the part of the operator after being placed in operation and has a very rigid, strong body mounted on a substantial pedestal, bringing it up to a convenient height to the operator. All essential working parts are entirely enclosed in the body, fully protected from all dust, dirt and other foreign matter. All moving parts are provided with ample adjustments for taking up wear and insuring absolute accuracy of action and durable service without deterioration. The very best of workmanship is put upon this machine throughout. Any standard shape or spacing of tooth may be readily obtained by hand wheel adjustments conveniently located to the operator.

QUICKLY ADJUSTABLE BENCH VISE

The Barnett Foundry & Machine Company, Irvington, N.J., has just brought out a machinist's bench vise under the name of "Winans' New Idea Vise" that

QUICKLY ADJUSTABLE BENCH VISE.

embodies several novel features. Reference to the illustration herewith presented will show its general characteristics. It will be seen that the old fashioned screw and lever has been replaced by a pawl and rack. This is actuated by a handle on an eccentric shaft, which will exert a pressure many times that possible with a screw.

The adjustments from zero to maximum are made instantly with one sliding movement. The pawl eccentric and sliding jaw form a toggle joint, bringing the greatest pressure to bear on the top part of the jaws, causing the work to be clamped tightest at the working part. The moving member of the vise slides away from the operator and there is no handle between operator and the vise. The gripping plates are hardened and ground, and the rack and pawl are also hardened steel.

A feature of importance is that the whole vise may be removed from its swivel base and taken to surface plate, drill press or milling machine for continuous operations, since the base of the vise is accurately machined to right angles with the jaws. These vises are made in standard sizes of jaws from 3 inches to 8½ inches, and openings of 3½ to 12 inches.

A certain learned Queen's counsel was arguing a commercial case before a learned judge. In doing so he had occasion to speak repeatedly of an "eccentric," and the judge at length asked him what an eccentric was. The magistrate said he was familiar with the term as applied to individuals but not to things. The Queen's counsel at once complied. "An eccentric," he said, "is a circular disk whose centre is not in the middle."

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A Strike That Should Not Have Been

THE business of a good many cities was interfered with when the postmen went on strike. Mails were held up, important orders cancelled and no small monetary loss resulted.

The department at Ottawa should never have allowed that strike to come to pass. The fact that it did was evidence of administrative incompetence.

The men were underpaid—grossly so, and the trouble was on the horizon a long time before it broke.

If any department of Canada's government is due for a rattling of dry bones, the finger points to the post office department.

Mistaken Idea of Secrets of the Trade

DID you ever come in contact with the mechanic who was always afraid that some person else in the shop would learn his ways and methods of doing certain jobs? The chances are that if you have had much experience you have met this chap several times over.

He has failed and failed miserably to grasp the idea that giving away knowledge does not make him any poorer, neither does the withholding of it make him any richer.

There are men to-day who might have developed into real good mechanics had it not been for the "stand pat" type of mechanic with whom they became associated early in their experience. This mechanic, perhaps a foreman, failed to make the trade interesting. He kept his ways and devices under a bushel. He always made it a plan to let the new man "go in and find out for himself." He may have done it to try and develop initiative in the men under him, but it does not work out that way. Apprentices came to him, they served their time, and they went their way. They might have been experts—they might have left that shop qualified to go in any place and begin work—they might have gone out knowing that they were "real mechanics." But they didn't. They may have dropped into better environment later on, when they would have a chance to develop the real things of the trade. But the fact remains that there are shops, and plenty of them, where the mechanics have not yet learned the great truth that it pays handsomely to make the young apprentice a capable hand before he leaves the shop.

There is another phase to this same situation, and that is the experience that mechanics can pass along and put on record through the medium of such papers as CANADIAN MACHINERY. The mechanic who has had experience that makes work easier, that brings better results for the firm, has a responsibility, and that responsibility is to try and bring others up to the same standard of efficiency he himself has reached. Firms are often forced to spend hundreds and thousands of dollars in experimenting to find out what some other group of men already know. The result is that industry—viewed from the larger scope in the national field—loses, and a tremendous amount of energy is wasted, all because the mechanic with the knowledge saw best to keep it to himself.

Remember this. You are not going to be any poorer because some person else knows as much as you do. It is not going to cut the ground from under your feet because you help some other chap to get the training that will enable him to hold down a good position and do the work well. Your reward will be greater than any that a paper can pay for your material. It will be in the form of satisfaction in having helped some person to make two dollars where he was making one, and in making a good mechanic out of the chap who is now being pitchforked out of the shop as a handyman.

Alberta And Its Big Problem

ALBERTA coal is surely having a merry time trying to make its bow to the people of Winnipeg. If all the energy that has been spent in investigating and reporting had been applied directly to the production and application of coal there would be quite a few bins filled to the ears by now.

Here's the way the situation is summed up in one of the numerous reports that have been issued:

> In this connection, it is claimed that the majority of Winnipeg dealers are absolutely hostile to Alberta coal, while a few who are genuinely boosting it are carried away by their zeal and led to extravagant claims which must result in dissatisfied consumers.

Now the thing most necessary seems to be a quota of dealers who will have just the right amount of thuse in their system. They must not blow off too hard or the consumers will expect too much. Neither must they be too frigid or the frigidity is likely to extend to the order books. Apparently it has not occurred to them to let the dealers get out and peddle coal like they used to pitchfork real estate bargains around.

But apart from what the people of Winnipeg think of Alberta coal, or what the operators think of the people of Winnipeg the fact remains that it's a long cry between the present production of Alberta mines and what should be forthcoming to meet the winter needs of Western Canada. One report just issued has this to say:

> That a short crop of wheat in Southern Alberta, and Western Saskatchewan will reduce the amount of coal consumed in that area.
>
> That the short crop will release much labor for the mines this fall.
>
> That the short crop will release sufficient rolling stock from the normal traffic in wheat to carry Alberta coal Eastward through the crop moving season, thereby averting the danger of a calamitous shortage of fuel in Manitoba.
>
> That labor conditions are intolerable, alien miners, instead of the operators, are actually operating the mines at present. In this connection the department of labor and the mine administrator are severely criticized, it being declared that their method of keeping the mines operating is to grant every demand, no matter how unreasonable, made by the miners.

When it is remembered that the West has about three months left before the coal burning season starts, it's a mild statement to remark that the situation west of the Great Lakes looks serious.

OUR idea of a man with great foresight is the chap who whacks moths out of his winter underwear while the thermometer shows 95 in the shade.

HAS FAITH IN CANADA

American Has Developed a Nice Selling Business For Steel Trade in Canada

IT seems to have been the trend in recent years, and especially in connection with the industrial development of Canada, that the drift of steel men has been northward. This is true in connection with the actual operations in the steel plants as well as with the sales end of the steel and iron business.

Ralph B. Norton, Canadian agent of the Kayser, Ellison & Co., Ltd., Sheffield, England, was born in Essex, Mass., in 1880, his parents having come previously to that country from England.

RALPH B. NORTON.

Shortly after leaving school he entered the steel business in the employ of the New England agent of Kayser, Ellison & Co., Sheffield, and the Crucible Steel Co. of America. For 13 years he was connected with this branch through its various offices, becoming conversant with all lines of steel and making a special study of alloy steels. He travelled extensively through Eastern United States and became one of the best known steel salesmen in that section.

While in Sheffield in 1913 Mr. Norton accepted a commission to open a branch for Kayser, Ellison & Co. in this country. Although this mill was one of the largest and most progressive in Sheffield, it was not so well known here, but in five years' time by untiring work, perseverance and up-to-date methods he has brought this new branch to a par with the older established English firms.

On the outbreak of war and the curtailment of English shipments, his acquaintance with the American steel manufacturers and sources of supply enabled him to take care of his ever-increasing trade. Mr. Norton is of a genial disposition, and has won a host of friends both in the East and in Ontario, where he contemplates opening a second branch.

He became greatly attached to Canada, and is full of praise for the way our Canadian manufacturers have risen to the call for greater production in every line. He is confident that any difficulties arising in business conditions through adjusting ourselves to times of peace will be met in the same unconquerable fashion.

SCORES THE "DEAD ENDS"

Invesigation Into Causes of Some of the Recent Fires That Have Occurred in Toronto

THE deputy fire marshal for Ontario, Geo. F. Lewis, conducted an investigation into the Thor Ironworks fire. The matter of its possible origin was gone into at some length, also the methods employed in fighting it, water pressure, etc. Considerable evidence was brought out regarding the employment of foreigners and the need for rigid care in this regard.

The part of the greatest importance, however, was that applying to the fire fighting forces and the supply of water. The "dead end" situation in water mains is one that probably exists in every city, and what applies in Toronto will have equal force and warning in other centres. One matter that was brought out in the investigation was the fact that it was quite possible for foreigners or any person, for that matter, to enter certain parts of the works at any time, a practice, which in the opinion of the investigators, should be curtailed as far as possible in times like these.

The Shortage of Water

In connection with the actual circumstances of the fighting of the fire, Lieutenant Mitchell on being examined stated that the first line of hose was connected with the hydrant at the Thor Iron Works gate, and with that he fought the fire from the water front side till their hose caught fire and they were cut off. It was shown that for about six minutes the pressure on the first line of hose was alright, but as soon as additional lines were laid they took away the pressure. It was even established that when the pressure started to go down they could only hit about the bottom of the second floor and it continued to drop until their hose was burnt and they were cut off entirely. The department that was fighting the fire at the Thor Works had to depend upon the Bathurst and the Spadina main. The hydrant at the foot of Spadina about fourteen hundred feet distance was also used. It is on a five-inch main and also a "dead end," so that all the water the fire department had to fight the fire with was from 2 six-inch mains on "dead ends." The Spadina Ave. connection wasn't much good as a fire fighting proposition either on account of the friction. There would be very little pressure after the water got through the 1,600 feet of hose running from Spadina Ave. to the scene of the fire.

The Evidence of the Chief

The chief of the Toronto Fire Department himself in giving evidence said, "that the big trouble was we didn't have enough water. The firemen were hampered by the lack of hydrants, bad roads, as well as lack of water, together with the necessity of laying long lines of hose." The chief also added that there was no reason why that plant would have been entirely burned like that if we had had roadways and the water. It was also brought out by the chief that he had applied to the Water Works Department of Toronto for blue prints showing the location of hydrants and sizes of mains in the various streets throughout the city, and had not yet got them and was thus without the proper scientific knowledge from a fire fighting standpoint of what he was up against.

At one time during the investigation Mr. Lewis, the deputy fire marshal for the Province, asked the fire chief this question: "If you had had proper water pressure at these fires the chances are it would have reduced the fire wastage enormously?" and the chief answered quite frankly to this that it would have made a wonderful difference.

William Corbett, district chief in the fire department, in his evidence went on to show that the fire department was badly hampered on account of bad and crooked roads, and insufficient water supply in fighting the Thor Iron Works fire, together with the delay caused by laying

Continued on page 76.

MARKET DEVELOPMENTS

War Industries Get the Preference

Firms Making Other Lines Are Having Hard Time Securing Supplies From War Trade Board—Small Chance of Any Material For the Commercial Users of Steel

THE Canadian manufacturer who is not working on war orders is not faring well in some cases, and the future has not much in store for him if he has to come to the War Board asking for supplies. True, the situation is not one that has developed over night, but the drift in that direction has been gradual and very persistent for some weeks, until now in some industrial for pig Iron had been turned down by the War Trade Board. centres it is being quite marked. Only this week one manufacturer in Toronto was informed that his request His lines are soil pipe, fittings and boilers for stoves. At present his firm has enough material on hand to run for six weeks, but at the expiration of that period he will be out if he cannot secure assistance, or turn quickly to other lines that will find favor with the War Trade Board.

There has been a feeling in the steel trade that about this time of year there would be some steel for distribution to the commercial users. It had been thought that after a three-months' concentration on war work the demands would have been overtaken. Just how far this guess is wide of the mark is shown by figures given out to-day in United States. It appears that the estimates of the requirements of the war group there for steel for the second half of 1918 will be 20 millions tons of steel, while at present the mills are only producing at the rate of about 16 million tons for that period. There seems to be little prospect of bringing production figures much past the point where they now are. From this it will be seen that there is small chance of commercial users of steel either in Canada or United States getting any supplies this year.

The fortunes of war bring many peculiar turns in the market. Only a few weeks ago the talk was about the great quantities of steel rails at Vancouver on order of the Russian government. This week in New York some 200 large machine tools are offered to the trade because they had not been shipped to their Russian orders. And it is also reported that agents from industrial and government quarters in Brazil are in American cities this week asking about the chances of securing machine tools for the manufacture of munitions to the order of Brazil.

The demand for pig iron and scrap is not satisfied in Ontario or any part of the Dominion. At American points it is being cornered for war work absolutely. A survey was recently taken in United States, as a result of which some 300,000 tons of pig were taken from non-war industries and turned over to firms that were working on essential contracts.

MONTREAL SEES NO CHANGE OF STEEL BEING SERVED FOR COMMERCIAL PURPOSES

Special to CANADIAN MACHINERY.

MONTREAL, August 1.—Continued hot weather has somewhat affected the tone of regular operations, and this is reflected in almost every line of activity, in particular, those industrial plants working on the production of furnace steel. Rolling mills and steel foundries have experienced a strenuous week owing to the continued hot wave. Machine tool trade has shown a languid tendency but the volume of business has been quiet heavy, owing to the early requirements of shell plants now under construction. Metals have had a comparatively quiet week with prices well maintained. Old materials are without feature at steady prices.

Production Slightly Reduced

As generally expected during the summer months, the output from the steel mills throughout the district has shown a falling off, and should the extreme hot weather continue this feature will become additionally emphasized during the coming weeks. Another factor that materially affects production is the holiday season when many are away from the offices and factories. Steel, both in the form of bars and billets for the recent renewal orders for shrapnel and high explosive, is being made in larger quantities. During the past few weeks it has been rumored that steel would be more easily obtained for other than essential war work, but as stated in previous letters, the situation has shown no tendency to change towards a more favorable distribution of steel; as a matter of fact the increasing demands in the United States for all classes of war supplies has resulted in reducing any quantity that might appear available for non-essential consumption. The abnormal requirements, however, make it very difficult to acquire steel for ordinary purposes, but owing to the indirect bearing that all existing activities have to the actual prosecution of the war, the business that might be termed of no importance is very hard to define. It is this condition that increases the necessity of careful supervision in the distribution of the output from the mills.

While it is possible that some action may be contemplated, on the part of the Canadian Government, in the matter of some form of price regulations, it is not taken seriously by the steel men here. The comparative volume of material that is produced in Canada to what is received from American mills, makes the regulation of steel prices here a very difficult problem, and one that could not very well be solved satisfactorily under existing conditions. Dealers here report a quiet period, largely as a result of weather and the holiday season.

Prices continue firm and unchanged on a market that is exclusively confined to war activities.

Features Developing in Metals

The week has passed without any local developments and the markets continues steady and firm. Interesting features however, are looked for in the near future owing to the movement in copper circles regarding a further revision of price, and to the uncertainty prevailing in tin, as a result of recent restrictions imposed on shipments of metal from is very heavy, exceeding the visible supply. Lack of inquiry has weakened the spelter market. Antimony is stronger with aluminum steady.

Copper.—Further agitation for another advance on copper has created a situation similar to that prevailing just prior to the last recent revision, so that the general tone of the market, if it may be termed such, is one of uncertainty, coupled with a nervousness on the part of the trade in covering their requirements. Few sales are made apart from price at time of delivery, so that those consumers with sufficient for immediate requirements are reluctant to place further orders under these conditions. Local dealers report a good business with supplies hard to obtain. Quotations are firm at 30½ and 31½ cents per lb.

Tin.—Developments at the source of supply are taking a turn that may eventually result in materially affecting present uncertain conditions, and these developments will not tend to ease the tension of the past several months. Closer regulation of shipments of Straits tin will mean a further period of nervousness, particularly on this side of the Atlantic. Dealers here report a declining supply but are able to satisfy customers for their most urgent requirements. This week's quotation show a stronger a stronger situation, the 5 cent advance placing the price (nominal) at $1.15 per lb.

Lead.—The heavy demand for lead and the evident scarcity has created a stronger undertone in this metal. Dealers here continue to quote 10½ cents but look for a stronger market.

Good Business in Machine Tools

While the present demand for equipment is not excessive, the dealers and manufacturers are actively engaged in placing machines that have been on order for some time. The rapid progress that has been made in the erection of several local munition plants, to take care of American and new shrapnel orders, has required the speeding up of machinery delivery. This equipment is coming along in good volume and it is anticipated that little delay will result after the completion of the buildings. New tools are the ones particularly in demand but very good business has been done in used equipment. One machinery house here recently disposed of the entire shell equipment of a large locomotive plant, the total value approximating $250,000. Much of this machinery was absorbed by other plants in the district. Local builders of special shell machinery are very active. Demand for all classes of supplies continues very heavy.

POINTS IN WEEK'S MARKETING NOTES

Reliable figures compiled in the United States show that the war requirements for the second half of the year will be twenty million tons of steel, while the output looks to be about sixteen and a half million tons. This would indicate that there is a very small possibility of any steel being left over for commercial users.

—

Although the story has been in circulation ever since U. S. began to manufacture war material that there was sure to be a labor shortage in the steel industry, the fact remains that at the present time in spite of recruiting, and all other drains upon labor, that the mills and furnaces are all very well furnished with labor.

—

A list of some 200 machine tools which originally sold through Russian firms, have been placed on the New York market.

—

Agents from Brazil are now in New York getting figures from dealers there on a number of tools for munition work in Brazil.

—

United States steel men are all agreed that it is not advisable to build any more furnaces there at the present time

—

As a result of a survey of the available pig iron in the U. S. some three hundred thousand tons were taken from plants working on non-essential contracts and given over to plants that were filled up with war orders.

—

Several Ontario firms have been notified that their request for a supply of pig iron have been refused by the war trade board.

—

Several of the large producers in American points have notified their old customers that if they wish to secure allottments of pig iron for 1919, they will have to get their plants into shape to handle war contracts.

—

A record is made this week in an unusual way, in that no changes are recorded in the market prices of steel or iron.

NON-WAR INDUSTRIES CAN'T GET SUPPLIES

Pig Iron Being Cut Off and Saved for Group of War Industries

TORONTO.—From time to time the statement has appeared that there was a tightening up in the supply of basic materials to the various institutions in the Dominion. Although a great deal does not appear on the surface, evidence is occasionally found which goes to show that the supply of such materials as pig iron is being dealt out to the war group in quantities in keeping with their needs. In fact it is seldom that a complaint is heard from any of these firms that they are being held up for want of material. There is a fairly good system worked out by which the War Board keeps the situation pretty well in hand.

Other firms are not faring so well. The representative of CANADIAN MACHINERY has met several outside foundrymen this week who were in the city in search of pig or good scrap. They are not being well served, and in some cases the supply has diminished to such a point that a temporary shut-down is in sight unless something comes along to relieve the situation, and that something is very uncertain at the moment.

Just to-day one firm in Toronto, manufacturing hardware supplies, soil pipes, fittings, stove boilers, etc., was turned down in its request for pig iron. This firm has enough material on hand to run along about six weeks, and unless it can go over to war work, the prospects are for a shut-down for a time at least.

Steel Prices Hold

No changes are made in any of the quotations in the steel market to-day, and indications point to a continuance of values that have been named for some days. From information received at this office it would seem that there is a fairly large amount of structural building waiting until there can be a supply of material for that purpose. Inquiries have been made at several of the firms dealing in structural steel, and the information is invariably given that it is useless to put in the order at Ottawa, for the simple reason that the War Board will not entertain it.

Conditions in United States are reflected here to a large extent. In a recent survey made of the pig iron situation there, some 300,000 tons of pig iron were found in the hands of industries that the War Board there refused to recognize as "essential." Recognition being denied them, this amount of material was confiscated and placed with firms that were working on strictly war contracts. No such action has been taken here, because supplies are hardly allowed out in proportions large enough to permit of such a situation.

Scrap Metals

There is very little trade moving in the scrap metal market this week. Dealers are keen to secure anything in the nature of good foundry scrap for the demand for it is very marked. As a matter of fact, though, users of materials that usually go into scrap in the course of time are holding to them now, as the cost of replacement is a feature that they have to consider. Railroads in Canada are following the same policy as those in the States, and they are making their stock work overtime to cope with the transportation problems that they are facing.

Although prices for copper scrap, turnings and wire advanced quite sharply in sympathy with the new fixed price in United States, dealers do not report any larger amounts coming into the market.

Occasionally the question of reclaiming tin comes up. No doubt the $1.25 per pound price at which tin is moving has something to do with the agitation to reclaim certain portions of it. There is nothing of a practicable nature in the proposal as far as this country is concerned. It would take between seven and eight thousand tin cans to weigh a ton, and the value of the cans would be about $12 at the factory, according to present prices.

In Narrower Margins

Dealing in copper is coming gradually into a smaller compass. Dealers are not able to go into the market and buy all they want. There are limits now, and they are very closely defined, with the consequence that the available supply of copper is becoming scarce.

Prices for certain kinds of copper, for special uses, are advancing very much in excess of the price for the commodity fixed by the authorities. For instance, copper in the form used by photo-engravers is a hard thing to obtain and prices on that line have been advanced quite sharply, the result being higher prices for printing illustrations, etc.

Dealers here report only one minor change in market quotations, lead having moved up a half cent per pound.

Machinery and Supplies

Machinery for munitions plants comprises the principal class of business moving now. In this connection it is interesting to note that the Leaside Munitions Co. are proceeding with the construction of a new plant for machining 12-inch shells. Orders for a considerable amount of the machinery have been placed and also the contract for the transmission equipment. Local dealers report business as being fairly good but with a quieter tendency. Express shipments continue slow and are not much quicker than freight shipments.

An advance has been made in electric weld-proof coil chain. New prices now named range as follows: 3/16 x 5, $18.25; ¼-inch, $15.65; 5/16-inch, $13.15; ⅜-inch and larger, $11.90. A corresponding increase in other sizes and qualities has also been put into effect. Practically the entire line of the Stanley Rule and Level Co.'s goods has advanced. Prices generally on machine shop supplies are holding firm, with a shortage in some lines.

BRIEF REPORTS ON SCRAP AND PIG AT BIG PRODUCING POINTS

Reports on the pig iron situation in the various industrial centres are as follows:

Pittsburgh.—The survey of the pig iron supply recently conducted has resulted in close to 300,000 tons of iron under contract to certain consumers being taken from them and given over to companies working on big war contracts.

Chicago.—The smelters in general have enough iron with which to carry on current operations but some of them are not sure how they will fare when their present stock is exhausted.

Birmingham, Ala.—The inquiry for 1919 delivery has increased but the booking of orders has not resulted. The making of tentative agreements with the understanding with regular customers that if they shall be on war work in 1919, the iron will doubtless be forthcoming, is about as far as the producers have gone. A large company has issued notices to customers informing them of the necessity of getting on a war basis at once if they wish to be considered in the list of 1919 iron customers.

St. Louis.—Stove foundries are badly in need of pig iron and a considerable tonnage could be disposed of to these plants if the same were available.

Buffalo.—At the present time Government work is taking up practically the output here, but the furnace men hope later on in the second half to have some iron for distribution on old contracts.

Philadelphia.—The producers of pig iron here are not showing any great readiness to take on 1919 business, for the reason that they are not certain that their products will go to the parties to whom they sell. It has been their experience that large quantities of their material have been taken by the Government and sent to parties who have not been customers of theirs in previous times. And at the same time their own trade was neglected.

Cincinnati.—An investigation of the situation affecting the stove makers reveals the fact that very few of them in this territory have sufficient to carry them through the year.

New York.—The general opinion here seems to be that there will not be a pig shortage and at the present time shipments are moving forward satisfactorily so that few complaints from the melters are heard.

The Scrap Metal Reports

The reports on the scrap metal situation from the various industrial centres are in part as follows:

Pittsburgh.—As a result of the recent movement on the part of the authorities to bring all available scrap on the market, a good quantity of this has been found, but the trouble is that much of it is from very remote points. Whether it will be moved or not is a question that has not been settled because the freight rates to bring it to the smelting points would be very high. There is a very decided scarcity of steel, making scrap and the quantity of material is getting past what in ordinary times would be quickly rejected.

Chicago.—More steel scrap should be coming out and that it is not is charged to indifference which should not exist at this time, and a continuance of this attitude may lead to a serious shortage.

St. Louis.—Some of the railroads are offering small lots of scrap from day to day as they accumulate, or as they can be picked up with the short labor supply. Firms that are filled up with military work seem to have very little difficulty in securing smelting material.

Buffalo.—The demand for scrap is particularly heavy and largely exceeds the supply. Numerous inquiries are still unsatisfied. Heavy melting steel also continues in demand at a rate that exceeds the supply.

Cleveland.—It is said that many foundries would be glad to use a larger proportion of scrap in their mixture than at present. They are unable to do so as most of the pig iron that is being supplied is low in silicon.

RUSSIAN ORDERS NOW ON MARKET

Tools Made in States Were Never Shipped to the Eastern Land

Special to CANADIAN MACHINERY.

NEW YORK, Aug. 1.—Makers of guns and shells have placed contracts for machinery in the last week calling for the expenditure of $3,000,000 and similar contracts are pending involving the expenditure of $5,000,000. Manufacturers of aircraft and builders of ships have also placed substantial contracts for machine tools and other machinery. The conversion of many metal working shops in the Central West into war munition plants is resulting in a steady stream of small orders for shop equipment.

The Otis Elevator Co., New York, is about to place orders for 165 machines to be installed in its Yonkers, N.Y., plant for the manufacture of recuperators on gun recoil mechanism. The Himoff Machine Co., Astoria, N.Y., that is making gun mounts, is buying boring and other heavy machinery. The American Car & Foundry Co. is seeking to place an order for 132 24-inch lathes for the turning of shells to be installed in its Cincinnati plant. The same company recently purchased 150 heavy type lathes with the Niles Tool Works Co. Hamilton, Ohio, for the turning of large projectiles for the United States Government.

Big 12-inch Orders

The Maxwell Motor Co. has received an additional contract from the Government for the machining of an enormous quantity of 12-inch shells. The contract price is approximately $40,000,000, making this company's total war business $75,000,000. To expedite the work, the Government will give financial assistance

in building a $4,000,000 addition to the company's plant at Detroit. The Winchester Arms Repeating Co., New Haven, Conn., is buying $500,000 worth of shop equipment to make additional Browning guns for the Government. The New England Westinghouse Co., Springfield, Mass., has bought tools for gun-making and the American Can Co., Edgewater, N.J., has purchased supplementary tools for shell work. American Radiator Co., Bayonne, N.J., is buying additional machinery to increase the output of guns.

These Didn't Go Over

A list of 200 miscellaneous tools which were originally sold to Russian manufacturers has been made out by a local dealer who is now offering the machinery to American manufacturers, as the tools were never shipped and are still carried in New York warehouses. The Brazilian Mission is getting figures from New York dealers on a number of tools for munition work in Brazil.

The Scullin Steel Co., St. Louis, which is building a munition plant for the War Department, has awarded a contract for forge shop machinery to a Cleveland manufacturer.

The Mobile Shipbuilding Co., which has been building wooden ships for the Emergency Fleet Corporation, has received a $12,000,000 contract to build twelve 5,000-ton steel ships; each boat will require 1,670 tons of steel plates and shapes or a total of 20,000 tons and bids are now being taken on the fabrication of the full tonnages of steel, but it is possible that half of the tonnage may be fabricated at Mobile where additional shops and also three more shipways will be constructed. Cranes and machinery for the new plant will be purchased in the near future.

The Bethlehem Shipbuilding Corporation is planning to build two more shipways at its Moore works, Elizabethport, N.J., and also three additional ways at its Sparrows Point, Maryland, plant. Ocean going tugs will be built at Elizabethport and cargo ships at Sparrows Point.

Have Large Orders

The Todd Shipyards Corporation, New York, recently received an additional $15,000.000 contract from the Emergency Fleet Corporation to build twelve 7,500-ton freight boats which will be constructed at Tacoma, Washington. The Government contracts now held by the Todd interests amount to $75,000,000. Several new shipbuilding companies have been incorporated, including the Fabricating Ship Corp., Richmond, Va., with a capital of $1,000.000, and the Connecticut Shipbuilding Corp., New Haven, Conn. The Baltimore Drydocks and Shipbuilding Co. is making plant additions and installing new machinery.

A ¼-inch high-pressure cold water connection to the space below the discharge deck of a pump will prove a quick and effective remedy for vapor bound pumps, also an automatic valve is sometimes connected to this space for exhausting the air or vapor.

THERE'S NO CHANCE FOR STEEL BEING LEFT FOR COMMERCE YET

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., Aug. 1.—There has been considerable discussion in steel trade circles the past week of the War Industries Board's general statement, mentioned in this correspondence a week ago, that the war requirements in finished steel for the second half of the year are fully 20,000,000 net tons, while the prospect, based on past performance, is for an output of 16,500,000 tons. The trade does not doubt that there are items which make up a total of 20,000,000 tons or more, but in some quarters there are doubts whether the consuming activities can actually utilize the amount of steel they are calling for, by the end of the current year. The time element, they insist, is precisely as important as the tonnage element. Particular attention is being directed to the fact that while as to the direct war activities the War Industries Board has its records of orders placed and its schedules of orders to be placed, in the case of the commercial industries that are given preference and should be supplied with steel it can have no information of corresponding character, but must depend upon estimates. If the direct war activities, involving the steel the Government itself buys, were to count up 20,000,000 tons, then there would be no use in including the "more essential" commercial activities in the preference list, for that would be an altogether empty honor. These essential commercial industries, including those engaged in the production and preparation of food, in the production of fuel and in the manufacture of clothing, together with the public utilities in general, are all expected to get steel, and more or less according as the supply stretches.

Nothing for Unessentials

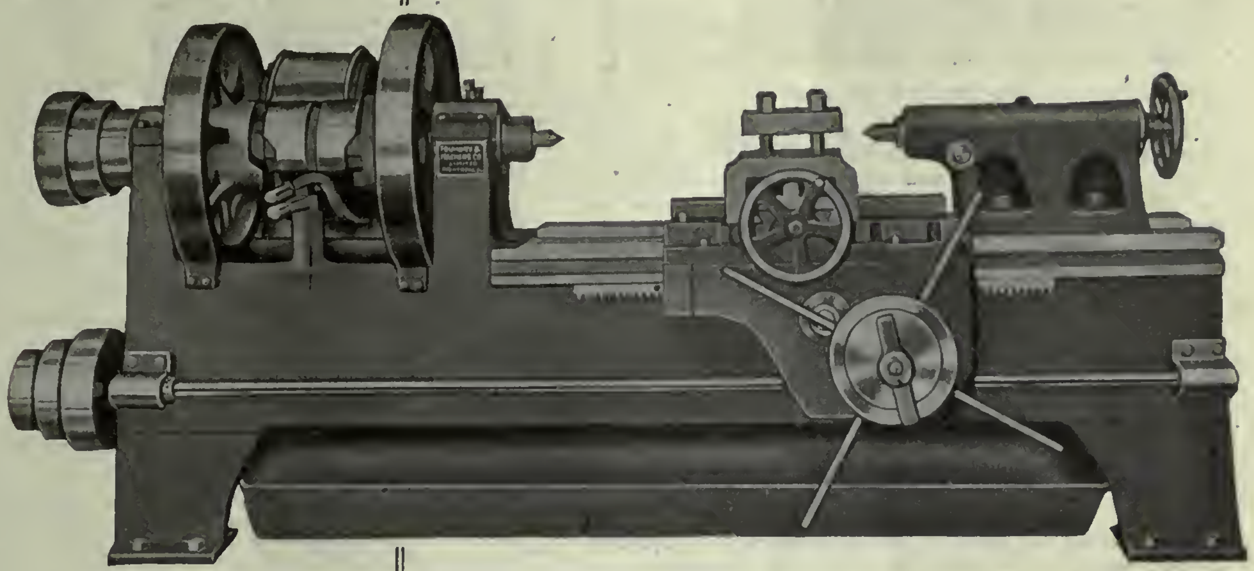
One thing has been made quite clear, that there will be little if any steel for the "unessentials" or "less essentials," these terms being used more or less interchangeably. In the first place, the supply will not stretch through the preference list, involving Class C steel, and then into the miscellaneous or unessential demands, such steel being designated as Class D steel, when there is any. In the second place, these consuming industries that are not accorded any preference represent a very small quantity of steel in the aggregate. If only they are to be denied steel there is not much steel saved. Various attempts have been made to compile a list of the "unessentials" but the compilers get nowhere. They start out, with a great flourish, by setting down "pleasure automobiles," not calling them "passenger automobiles" as the producers insist upon doing, but when they come to the next line and the lines following they have to leave them blank. The "preference list" is so comprehensive that there is scarcely anything left. There are items of demand that in normal times would be very important, but the industries involved have almost completely effaced themselves, with the country on a war basis, partly voluntary and partly forced by influences.

The problem of steel distribution, therefore, is to make the steel last down through the preference list, not to have it extend beyond.

Labor Conditions

There being so little that can be done to improve the distribution of steel, attention is directed more to production. It is regarded as decidedly not feasible to build additional plants. That would require a great deal of time and consume labor, materials and transportation facilities. What is of more importance is to obtain maximum production with the plant equipment now available. The problem is largely one of labor supply and labor performance. It is remarkable that the iron and steel industry is in as good shape as it is, when it is recalled that ever since the fore part of 1915 there has been more or less of a "labor scare." It will be recalled that the industry reached an unprecedently low rate of operation towards the close of 1914. Then early in 1915 conditions began to pick up. As demand increased it was seriously contended that there would not be sufficient labor to operate the furnaces and mills at capacity, should demand arise such as to warrant full operation. Some labor had left the country on account of the war in Europe, and immigration was practically stopped, although prior to the war the net increase in population, due to the passenger movement, had been about 60,000 persons a month for two years. Throughout 1916, although operations at capacity had been reached, there were fresh scares. Then when the Government began drafting men to the colors the whole thing had to be gone through with over again.

Nevertheless the condition to-day is that the mills and furnaces are fairly well recruited with labor. There have been various offsets to the drain of labor, and nearly the whole of the offset can be traced to the wonderful work the Government has been doing, through various important activities. It created a Labor Policies Board which should devise means to secure the best performance. As a result of its deliberations the United States Employment Service is now being put into operation throughout the country. Employers engaged in war work and employing 100 men, are not permitted, after August 1, to recruit labor except through this one service. Its methods promise to be drastic, calling upon non-war industries to give up men. Then there are the conciliators of the Department of Labor, who seek to catch cases of industrial unrest, or strikes being fomented, in their incipiency, and many a strike has been averted, or speedily settled, by the work of



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64 WEST FRONT ST. TORONTO, CAN

SCORES THE "DEAD ENDS"

(Continued from page 153)

long lines of hose. The fire itself was not of an extraordinary or very serious character from a fire fighting standpoint when the department got there.

Too Many Dead Ends

William Randall, the Toronto superintendent of maintenance and distribution of the Water Works Department submitted certain plans, and in answer to questions put to him it was brought out that in the city there are at the present time no less than 556 of these "dead end" water mains. It is well known that it is impossible from a fire fighting standpoint to secure the same pressure from a dead end main as it is from a main through which there is a constant flow of water. One of the questions in regard to the Spadina Ave. service brought out a remark to this effect, "They practically had no water there at all," and the answer to this was "no" because the water was used by the engines on Bathurst Street and on the lines that were connected up on this hydrant, before it ever could reach that branch.

A New By-law Needed

The deputy fire marshal in conclusion draws attention to this report to a number of things he considers to be very essential in keeping the fire loss down, among other things mentioning smoking on premises, grass fires, old shacks as a fire menace, watchmen's service. He also states that the City of Toronto seems to be lacking in their authority to enforce the requirements of a proper inspection system and should without delay enact a by-law substantially as follows:—

Section 1. It shall be the duty of the Chief of the Fire Department to inspect, or cause to be inspected, all buildings, yards and alleys, as often as may be necessary, but not less than four times a year in the mercantile and manufacturing districts, and twice a year in other districts, for the purpose of ascertaining, and causing to be corrected, any conditions liable to cause fire, or any violation of any by-law affecting the fire hazard. Whenever said Chief or other duly authorized person shall find any buildings especially liable to fire by want of repair, or by reason of dilapidated condition, or defective chimneys, stoves, furnaces, etc., or by reason of any other cause, and when he or they shall find in any building, or upon any premises, dangerous combustible or explosive substances, or accumulations of rubbish, waste paper, empty boxes, or other inflammable material, especially liable to fire, or shall find obstructions to or on fire escapes, stairs, passage-ways, doors, etc., a record shall be made of such inspection, and the Chief of the Fire Department, the Deputy Chief, or the District Chiefs of the Fire Department shall order the aforesaid matters and things repaired, removed or remedied, within a reasonable time specified in said order.

Section 2. The Chief of the Fire Department shall keep a permanent record of all notices given pursuant to the power hereby conferred, and of all inspections and the results of such inspections, together with details of the measures taken to correct any defects or inadequacies so found.

Section 3. The Chief of the Fire Department, Deputy Chief, or District Chiefs, or the Police, or either or both of them, are authorized to enter at all reasonable times, upon any property in order to ascertain whether the provisions of the by-laws are obeyed, and to enforce and carry the same into effect.

Section 4. PENALTY. Every person found guilty of failure or neglect to comply with any of the provisions of this by-law, or with the requirements of any notice or order issued under the authority of this by-law, shall be liable upon summary conviction to a penalty of not less than five dollars ($5.00) nor more than fifty dollars ($50.00).

Section 5. All former by-laws or parts of by-laws inconsistent herewith are hereby repealed.

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these conciliators, whose work is rarely heard of except locally. Then there is the National War Labor Board, of which former President William H. Taft is one of the two chairmen, which has jurisdiction over cases of particular importance and has been very successful. There are various other activities that have been helpful, particularly in encouraging men to work harder through motives of patriotism in these trying days.

It is beginning to dawn upon the trade that remarkable work has been done, and that labor supply for war industries and industries closely associated with the prosecution of war is not going to be nearly as scarce as would have been imagined considering the amount of industrial activity and the large number of men called into war service.

TRIED THE BONUS SYSTEM TO SECURE PRODUCTION IN MUNITIONS PLANT

Some of the firms in Toronto that are taking on contracts for big shells are doing the first few operations this week, and it will not be long before they have production up to their former standards on other lines of work. One question that is not yet fully settled is the extent to which women will be able to find employment in the shops doing the large calibre work.

"The question of handling the larger shell is going to take a little consideration," remarked the official of one of the plants this morning. "In our case we find that the gravity system that was quite capable of doing the other sizes is not going to handle the big shell satisfactorily. And speaking of handling," he continued, "it is one of the items that simply runs away with money all the time, and it is always a hard factor in overhead. There is about as much non-productive effort in the making of shells for this reason as in anything we have ever handled here. Try as you will it can't be cut very much lower than a good many of the shops have it now, but even yet it runs into a lot of money in the course of a month. Firms want to get production at the maximum figure, and they want to have the machines constantly going, and it all means that the material has to be brought to the machines in a constant supply, and of course that all means that more hands have to be engaged.

The Women Workers

"Our own experience," he continued, "has led us to the belief that we would like to employ women workers here. "When we were pressed for production some time ago we adopted a bonus scale in our shops. We paid the same money to men and women workers on piece work operations, and they worked under the same conditions. We made it a practice as well to give a $2 bonus every time a shop record was made or broken. We did not ask the worker to wait until pay day and have the amount added then, but went on the view that a bird in the hand is worth two in the bush. We would hang up the shop marks on certain operations. Well, the thing was a big success all the way through. As soon as a worker beat out a figure that had been previously high in the shop, an order was given on the pay office, and the bonus of $2 was handed over right away. It was interesting to watch who would get the most of these, men or women. It was our experience that three out of five times the record bonus was paid over to a woman. And as I said before, the men and women were working under exactly the same conditions, and were getting the same rate of pay for their work."

ANOTHER METROPOLITAN DAILY GOES UNDER DEPARTMENT STORE CONTROL

It will be remembered that Stewart Lyon, editor of *The Globe*, Toronto, and the editor of a Winnipeg daily, speaking at the annual meeting of the Canadian Press Association, lamented the fact that editors of the metropolitan daily newspapers had not a free hand. They were hampered by their big advertisers, the owners of departmental stores.

Rodman Wanamaker, of John Wanamaker & Co.'s big departmental store of Philadelphia and New York, who controls the Philadelphia *Press Record* and *North American*, has just been appointed by the will of the late James Gordon Bennett to the control of the New York *Herald* and the New York *Evening Telegram*. Although in control he has not been, nor will he be active personally in newspaper work. It is interesting to observe another big daily newspaper pass under departmental store control.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

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Your "Uncle Sam" is Not a Bluffer in Any Sense

A Review of His War Activities Will Demonstrate That He Has Gone in for Keeps—In the Past He Has Shown a Tendency to do Things in a Big Way and at Once

By GEO. A. SIMPSON, Sales Manager Steel Co. of Canada.

NOTWITHSTANDING the following, which I clipped from a Canadian paper, your "Uncle Sam" is not a bluffer, and this the Hun will find out to his sorrow:

Washington, July 9.—Publication in Swiss papers of the text of Secretary of War Baker's letter to President Wilson, giving the American troops' movement to Europe by months, caused German authorities to permit its publication in Germany, according to a despatch received from Berne.

The *Koelnische Zeitung* published the latter under the heading "American Bluff," the despatch says, and commented as follows:

"Mr. Baker thinks he will be able to dissipate all doubts about exactitude of his figures with his recitations. It is, however, only the usual American bluff. We know from reliable sources that the figures in question are inordinately exaggerated and in no way correspond to the truth."

And furthermore, he will understand—if he does not already know—that the figures furnished by Secretary of War Baker are not "inordinately exaggerated," but they do correspond to the truth inasmuch as they only represent a small fraction of the force that will be exerted for the cause of humanity before the allied armies reach Berlin.

A Nation of Enthusiasts

The American is an enthusiast, fostering an ambition unbridled by traditionary restraint, for in him commingles the souls of the sturdy Pilgrim Fathers, beset with the cares of existence, conquering nature, felling trees, navigating rivers and fertilizing valleys, and the souls of the Colonists fighting for liberty and independence. He is the child of a country as boundless as the ocean, whose rivers are like rolling lakes, and the lakes like inland seas, the forests, the mountains, the plains, Niagara itself with its world of waters—all owe their magnificence to their immensity; and by transference, not unnatural although fallacious, the Sons of Uncle Sam have modelled their ideas and expressions on the huge scale of their magnificent country, and history proves that anything they have seriously set themselves to do, they have successfully accomplished. But this is to his credit, as nothing great has ever been accomplished without enthusiasm, but he is not a bluffer.

It is true, and I must admit that the words "bluff" and "bluffer" are often applied to American statements and to those who make them. As to why they should be applied to the extent they are, I am at a loss to understand, unless it is through the application of a mental attitude that parallels, in a sense, that of the German toward the English. During the course of the war, I have been asked a number of times by residents of the United States what has England done to incur the hatred of Germany—as no one seems to question that a deep-seated hatred does exist—and to those who first propounded the question, I was at a loss to make an answer. Therefore, I undertook to analyze the subject and I asked myself the question, "What has England done to Germany?" and for the life of me I could not reach any logical conclusion, other than the one I will later outline which justifies in the German mind the Song of Hate, or the toast of "Der Tag" which, in English, is "The Day," meaning the day on which they could pick a fight and thereby show their brutal superiority over a race that they recognized, but would not admit, were their superiors in every commendable particular. I have therefore concluded that their hatred is caused by a mental attitude, born of the fact that the Englishman is a gentleman and as such is recognized by every nation with whom he comes in contact.

Mighty Handy With a Knife

I have before me a mental picture—not altogether imaginary, as I have attended gatherings where different nationalities have sat at the same table—and I can see the German, fat and coarse, with his napkin stuck inside his collar, disposing of his soup with musical accompaniment, using his knife and fork with the same elegance that a plumber would use his tools; in fact, the knife is more to his liking than the fork. I have watched him through the meal, ill at ease, feeling that he was not in harmony with the thought and environment of representative men. I have seen him called on to make a speech, or responding to a toast, rising awkwardly and even where he could speak good English, it sounded to me like someone gargling his throat. In other words, the German is coarse; he is the offspring of a race of butchers, soap-boilers and brewers, and he knows it and shows it. On the other hand, across the table the Englishman, respecting all the good manners recognized in well-ordered society, is called upon to respond to a toast, and with the grace of a Chesterfield, he rises to the occasion and in a few well-selected words, he makes his response. The German knows he is not the equal of the race from which this gentleman sprang, and therefore dismisses the subject by saying under his breath "Englander Schwein."

But the English are not swine, neither is your Uncle Sam a bluffer, yet a state of mind has been created and does exist all over the world, including Canada, which prompts the dismissal of a statement, involving big figures or vast undertakings, made by an American, as "American bluff." To this I have applied the test and I wish to go on record and state in the most emphatic language, that all through the history of the United States I cannot find one instance where statements have been made which, I will admit, sounded like "bluffs," which have not been fulfilled. And I can only conclude that the reason the word "bluff" or "bluffer" has been applied by the people of every nation, who do not realize the stride your Uncle Sam is making, is because they cannot grasp the magnitude of the statements made and they dismiss the subject as "American bluff," while those who do realize it, resent it with the same remark.

Their Declaration of Independence, whereby they severed their allegiance from a crazy German King, sitting on a British Throne, was no bluff; neither was the Emancipation Proclamation, which gave freedom to the slaves, a bluff.

Couldn't Grasp the Idea

As a slight indication of the extent to which the word "bluff" or "bluster" has been applied to the inventive minds and the unbridled energy of the American people and as to how poorly it served as descriptive of their accomplishments, I may state a little incident that I well remember and have many times repeated. I was standing on the railroad platform in Newport, Monmouthshire, awaiting a train to take me to my home. I was then a boy, attending a British Public School. There were a number of other passengers waiting for the same train, among them being the vicar of the parish of Trevethin, a well known and renowned clergyman of the Church of England. He was talking to some farmers, who lived in his district, and the conversation ran about as follows: He told them that he had received a letter from a former member of the church, who had emigrated to America, stating that there had been invented and there was now in use in the United States a machine that while being drawn through the field, would cut the wheat, put it up into sheaves, bind it and drop it, ready for being put into shocks, as it went along.

The conversation was interesting to me as, boylike, I had profound respect for the vicar. I now recall the expression of doubt on the faces of the farmers, and the smile from the vicar who acquiesced with their thoughts, and I can now hear him distinctly stating that he very much doubted that such a machine could be made and applied in general use, with which the farmers, who were at that time cutting their wheat with a sickle, were very much in accord.

When we consider what the sons of Uncle Sam have done for the agricultural world and realize that their first attempts were classed as "bluffs," we can more fully appreciate how ridiculous and uncalled for the expression is. And what applies to the endeavors of Uncle Sam in the production of agricultural implements applies to everything he has seriously undertaken.

Three Days vs. Four Weeks

As a boy I went to sea in an English sailing ship, and I remember very well my first introduction to what I then considered "bluff." We had crossed the Atlantic from England to the West Indies with a cargo of coal and had run down to Pensacola, Florida, for our return cargo of lumber. After we had discharged our ballast, we were towed out into the bay, where our complete cargo of logs had been rafted and was there awaiting us. I remember hearing the stevedore, an Irishman, by the way, by the name of Pendleton, who had lived the best part of his life in the United States, telling his gang that he expected to load the ship in about three days. While I was a very young boy at the time, I shook my head and if I didn't say "bluff," I thought it. Notwithstanding we were loaded and ready to sail within the prescribed time and we arrived in England some ninety days later, where it took the English stevedore and his force some four weeks to unload what the American gang had loaded in a little over three days. No bluff about that.

Some years later I was on the Isthmus of Panama. It was shortly after the collapse of the French company, who had undertaken to build the canal. All the machinery and equipment was lying in idleness and rusting. The Isthmus was reeking at that time with yellow fever and disease and any man who spent much time there took his life in his hand. I was then advised it was impossible to build the Panama Canal, and to drive home this statement, my advisers, pointing to Monkey Hill, which in those days was the famous burying ground of the workers on the Isthmus, said there were more men buried in the cemetery on that hill than there were ties in the Panama railroad. In later years Uncle Sam undertook to "dig the ditch" and the first thing he did was to clean up the Isthmus from ocean to ocean. The greatest sanitary engineers the world knew were put on the job and when this part of the work was done and the Isthmus made fit for a white man to live on, that great organizer, Major Goethals, the canal builder, was ordered by President Roosevelt "to make the dirt fly." As to how well he did this work is now a matter of history; but the facts are the work on the canal. especially any reference to the gigantic dredging operations, were often referred to as Amrican bluff, and when the date set for the completion of the work was mentioned, it usually brought forth the stereotyped reply, "bluff." Nevertheless, the canal was completed and ships passing through it fifteen months prior to the official date set for its completion. Surely this cannot be termed "bluff."

They Came—They Saw

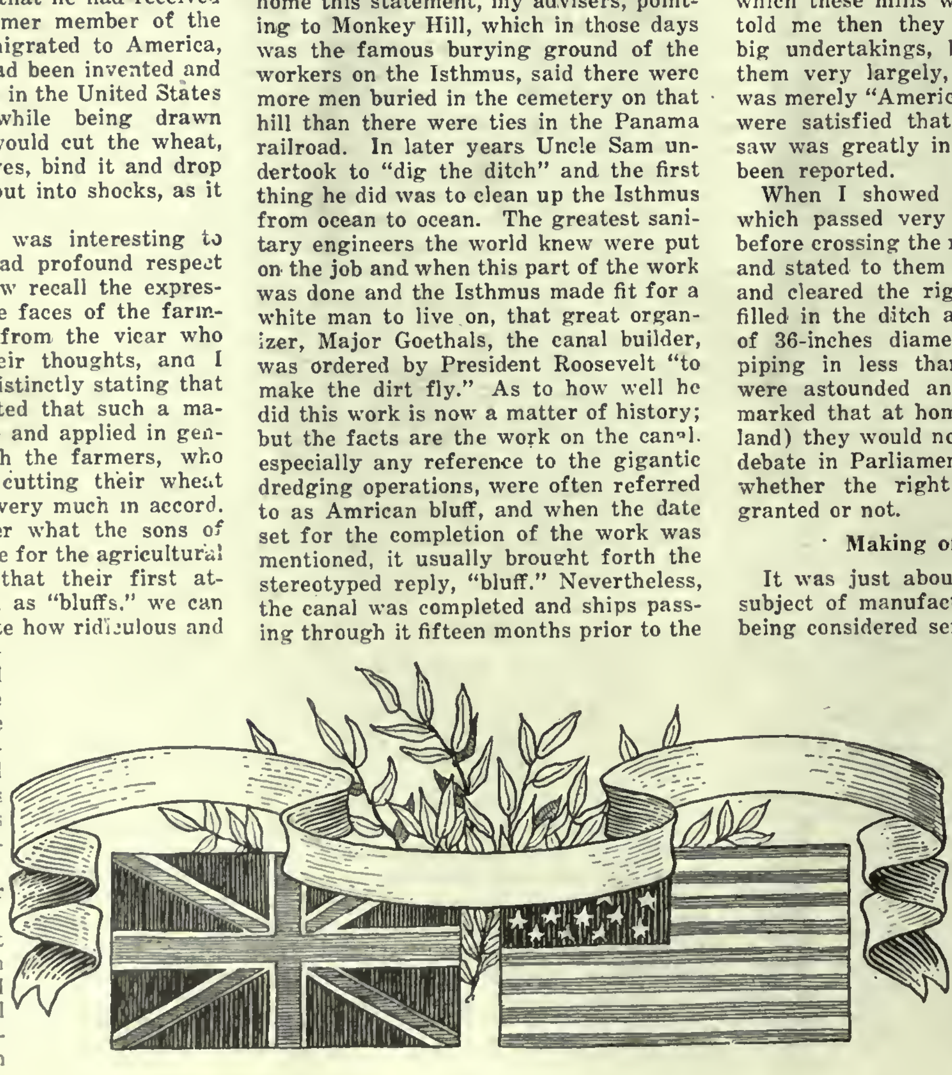
If my memory serves me right, it was in the year 1890 that the British Iron and Steel Institute visited the United States as guests of the American steel manufacturers. At that time I was associated with the T. A. Gillespie Co. We were laying natural gas pipe lines into the city of Pittsburgh and some of our construction records had evidently reached England. When the members of the Institute reached Pittsburgh, it was my pleasure to take charge of a party of six to conduct them through the steel mills at Homestead and, incidentally, outline to them what was being done in connection with the bringing of natural gas into the city. In my party was the president of the Institute, Sir E. Windsor Richards of Middlesboro. Mr. Clement Crowther, of Crowther Bros., Kidderminster, and Mr. Isaac Butler of the Panteg Steel Works. in whose mills I had worked in England, also a number of others, all of whom were descendants of families long connected with the iron and steel industry.

I recall now the statements they made on going through the mills and their utter amazement at what they termed "the gigantic buildings" and what in their minds was the enormous output, which these mills were producing. They told me then they had heard of these big undertakings, but had discounted them very largely, as they thought it was merely "American bluster," but they were satisfied that what they actually saw was greatly in excess of what had been reported.

When I showed them the gas lines, which passed very close to Homestead before crossing the river into Pittsburgh, and stated to them that we had secured and cleared the right of way, dug and filled in the ditch and laid eleven miles of 36-inches diameter continuous steel piping in less than five months, they were astounded and Mr. Crowther remarked that at home (meaning in England) they would not have concluded the debate in Parliament in that time as to whether the right of way should be granted or not.

Making of Tin Plate

It was just about this time that the subject of manufacturing tin plate was being considered seriously in the United States, and I so advised these gentlemen, and while they were willing to admit that all the statements that had been made in reference to pig iron and steel had been more than fulfilled, nevertheless it was not possible in their mind for any one to take Great Britain's place in the production of tin plate. They were



inclined to jokingly infer that my statements in connection with this industry bore a little resemblance to "bluff." I may state that to-day the United States leads the world in the production of tin plate, likewise pig iron and iron and steel.

There was no question as to the effect of what they saw on the minds of the members of the British Iron and Steel Institute, or as to the benefits obtained through their visit, as they all returned singing the praises of your Uncle Sam and voted unanimously that he was not a "bluffer." And on the Americans, who had come into contact and associated with this magnificent body of representative Englishmen, the impression was indelibly stamped that they were gentlemen in every sense of the word.

I could go on indefinitely reciting statements that were regarded as "bluff," but which were fulfilled to the letter. While the Alfonsos and Isabellas sneered at what they termed "American bluff," your Uncle Sam was not bluffing when he lifted the heel of Spanish tyrrany from the neck of the Cuban and cleaned up the Island of Cuba and dredged the harbor of Havana and thereby got rid of the filth of centuries, which made this beautiful island a hot bed of bubonic plague and yellow fever. As a result to-day there is no more beautiful spot on the Western hemisphere than the Island of Cuba and the city of Havana. It is true, while doing his work, he lost by death, through yellow fever, an eminent sanitary engineer, but he completed the job and made good his wildest statements. And what is more—he paid the bill and to-day Cuba is proud to be recognized as a protege of Uncle Sam.

The Boxer Incident

And while I am referring to paying bills, I might state that during the Boxer Rebellion in China, when the six big nations of the world undertook to quell the disturbance, they all went in with the understanding that China would pay full indemnity for every expense incurred in the undertaking. After the work had been accomplished and the civilized nations had withdrawn, which, by the way, does not include Germany, as she stuck and took possession of Tsing Tau Peninsula and refused to be dispossessed, maintaining that she was holding this possession as payment for the expense she had been put to, they rendered their bills—which ran into enormous figures—and all of them are being paid with the exception of the one rendered by your Uncle Sam, which he returned to China marked "paid in full," with thanks for the privilege of being given an opportunity to render such a service to humanity. Surely this is not "American bluff."

The feeding of Belgium in the early part of this war was no bluff; neither is the feeding of the Allied armies today, or that part that your Uncle Sam has played in this great war from the beginning. Referring to the feeding of the armies to-day, I am reading from an address made by Sir William A. M. Goode, an officer of the British Food

Ministry, before the Consumers' Council, in which he gave striking figures, showing how the people of the United States by self-imposed food restrictions have aided greatly in maintaining the food supply of the armies in the field. Sir William said:

"From July, 1917, to April, 1918, the United States exported to the Allies 80,000,000 bushels of wheat products. It was calculated by Herbert Hoover, United States Food Administrator, that fifty million of this represented the voluntary sacrifice of the American people. American exports of pork products to the Allies in March, 1918, were 308,000,000 pounds. This was accomplished by porkless days and ceaseless hog production in the United States. In January, Sir William continued, the Allies asked Mr. Hoover for seventy million pounds of frozen beef monthly for three months. In March 86,000,000 pounds of frozen beef were shipped. This was due almost wholly to meatless days in the United States."

Had this statement been made by an American, it would, no doubt, have been dismissed as "bluff."

I would like to furnish some more figures and I would if space permitted, but suffice to say it required more than bluff to supply Great Britain and France with over 1,500,000 horses and mules; millions of tons of steel and shell forgings, hundreds of thousands of tons of barbed wire, and tens of millions of completed shells, machine guns, revolvers, together with hundreds of millions of pounds of powder and cordite to assist in delivering these shells into the ranks of the Germans by way of British guns. Add to this the enormous quantity of machine tools and equipment that was shipped to England and France, which enabled them to speed up and take care of their own requirements. Add to these transports, trench diggers, tanks, automobiles, medical supplies, clothing, shoes—in fact, mountains of supplies—that were absolutely necessary for the very existence of the allied armies in the field. We grant he was paid for all this, but that he was entitled to. What I wish to bring to your notice is the magnitude of this undertaking and the manner in which it was carried out, and many times during the early period of the war I heard statements made by these American producers, who had undertaken this magnificent work, referred to as "American bluff."

Some 1918 Accomplishments

The building of the Liberty Mill at Homestead in six months for the rolling of ship plates, the construction of a one-hundred-million-dollar ordnance plant on Neville Island in the Ohio River, near Pittsburgh; the building of shipyards from ocean to ocean and the launching of ninety-four ships on the Fourth of July are merely incidents in the vast war programme mapped out by Uncle Sam. Yet any one of these undertakings is stupendous. They form parts of the American war machine, and you can take it from me that when this force gets properly started, there is no power on earth can stop it. It is no bluff; it is Uncle Sam's contribution to a righteous cause, and shoulder to shoulder with his Allies, he will drive it across the Rhine.

While I know from experience that the great majority of Canadians fully realize and appreciate that Uncle Sam is a good neighbor and that he is not a bluffer, I also know there are small cliques of narrow-minded individuals in Canada, who are earning their Iron Crosses and doing good work for the Kaiser by sneeringly applying to all things American the word "bluff" and thereby attempting to discount their most sincere efforts. Such individuals should, in my judgment, be reported to the proper authorities, where they would be given an opportunity to prove whether their remarks were merely expressions of their personal opinions, or whether they were paid for with German gold.

The Wrong Viewpoint

An incident I shall ever remember and long regret happened on a train some months ago. I was sitting in the parlor-car. We were leaving Hamilton, going to Toronto with a friend, and across from us sat the president of a large Canadian manufacturing company. He was reading a Buffalo paper and evidently some of the headlines did not please him. Handing ths paper to me, he pointed to an article and remarked: "What do you think of that American bluff?" The article referred to a loan of a few billions to the Allies and incidentally spoke of helping to deliver the punch that would knock out the Hun. I saw nothing objectionable in the article and called his attention to the fact that he was reading an American newspaper, and I further stated that, in my judgment, the help we would get from Uncle Sam was necessary and that had the United States not entered the struggle to take the place of recreant Russia, Germany might have forced a peace of her own devising upon the Allies, to which he objected, stating definitely that he would rather see the Allies beaten than have that bluffer take any of the credit. The cruelty of this remark was sufficiently effective to stun both of us, to whom it was directed, and while we felt like beating him up, or handing him over to the police, we ignored him; but not without taking his mental measure and concluding he was either crazy or profoundly pro-German, preferably the former.

I fully realize that Canada could exist without her neighbor; but it would not be a very modern existence, neither would it be a very progressive one. But I also realize that we can get along much better with the United States than without. We are absolutely dependent on Uncle Sam for a whole lot of our comforts. Take hard coal for one—yet notwithstanding there was a great shortage last year due to the war, it is a fact, the homes of Canada were more comfortably heated than the homes in the United States, and I know that the orders from Washington relating to the distribution of certain materials were positive, as a prominent official there told me that Canada was being treated as one of the States. This spirit prevails and governs the actions of Uncle Sam in all his dealings with Canada.

Canadians should not forget that Anglo-Americans wrote the Declaration of Independence and the Constitution of the United States; they produced George Washington. Abraham Lincoln and Woodrow Wilson; they were the makers of trails and the givers of laws; they opened up the American wilderness; they drove the roads and bridged the streams and the roads they drove were straight and the laws they gave were broad and kind, and to-day the eyes of the world are looking west for they know that your Uncle Sam is not a bluffer. They are beginning to realize what America stands for.

The Spirit of America

My message is prompted by the most sincere thought and best wishes, because I want Canadians especially to know what the spirit of America is. I want to get into their very souls the passion and love for the sons of Uncle Sam that the sons of Uncle Sam have for them. I want them to understand that their heart is as great as the nation over which their emblem of liberty flies, and what is more, it beats true and in sympathy with all that can be termed human fellowship. It is consecrated to the highest ideals of humanity in its noblest form. The spirit of America is liberty, but it does not invade the rights of others, for it well knows that to enjoy liberty, it must extend it to others. It pleads for the rights of men to think, to reason, to investigate to the end, that the future may be enriched with the thoughts of honest men. It implores every human being to be a soldier in the army of progress, and it extends to him every right it claims for itself, believing that when all men give to all others all the rights they claim for themselves, the world will be civilized. Uncle Sam has had his difficulties, but they have stimulated, rather than stifled, his energy and the spirit of America, born of liberty, justice and truth, has surmounted a greater variety and combination of obstacles than I believe ever fell to the share of any one people in the same space of time, and to-day it is returning to the world the fruits of the belief that the universe was planned for good and the blessings of Creation were intended for the admiration and benefit of all mankind.

STORAGE OF COAL

Some notes on the storage of coal with reference to the prevention of spontaneous combustion were given by Mr. John H. Anderson before the Institute of Marine Engineers, London.

The author said that his remarks were based in particular on experience gained with a heap containing just over 16,000 tons. The heap consisted entirely of small bituminous coal, of several kinds, washed and otherwise, some being of a character supposed to be dangerous for storing. Under these conditions extra care was exercised. Temperature readings were taken at 14 different places nearly every day, and occasionally also at the vent pipes, of which there were 50. Further, to find the hottest part, readings were taken at every foot from top to bottom at certain places. Previous experience indicated that the warmest place was between 6 ft. and 8ft. from the surface; hence 7ft. was established as a standard depth for temperature records. The temperature tubes were ¾ in. or 1 in. gas tubing, driven in from the top to the bottom of the coal and long enough to project 2 ft. or 3 ft. above it. In most cases the vent pipes were old scrap tubes about 8 ft. long and 3 in. or 4 in. in diameter, and were driven down to the 7 ft. mark, their ends being flattened, chisel-shape, to facilitate driving.

By taking periodical readings of the temperature of the pile and comparing them with previous readings ample warning was obtained to prevent a fire. If a readying of 90° F., which was adopted as a warning temperature, was obtained at any place four other temperature tubes were driven down north, south, east and west about 10 ft. from the warm tube. The tube which gave the highest reading next day was then made the centre, and other pipes put down in its direction, the idea being to locate the source of heating. When the warmest place was found an additional vent pipe would be put in there, and this generally arrested the rise of temperature. If, however, it did not, a trench was dug a foot deep on each occasion—that is if the readings remained at, say, 100° for three days the trench would be 3 ft. deep. In fact a temperature of 100° was never reached, but on four occasions, when 95° was recorded at a point where the coal was deposited to a depth of 16 ft., a trench was dug. Probably, however, this trenching would have been unnecessary had additional vent pipes been inserted. If a fire occurs, although plenty of water should be available to quench it, it is better to dig all round it, and if possible remove the hot coal.

In general the depth of the heap should not exceed 12 ft. to 14 ft. for small graded coals, or 9 ft. to 12 ft. for unwashed mixed coals. As regards slacks, a good deal depends on the composition. The author allowed two heaps of this material 10 ft. deep to rise to 120° before moving them, and they gave considerable trouble; even when they were reduced to 6 ft. there was a tendency for them to increase in temperature. Anything, such as pieces of wood, pit props, rags, waste, shavings, and straw, that ignites at a lower temperature than the fuel should be kept out of the heap. As a rule the greatest danger is up to about three months from the time the coal is taken out of the pit.

APPROVAL VS. CRITICISM

"I am a believer in the fact that men do their greatest accomplishments by proper encouragement, not by criticism. I have yet to see the man, however great and exalted his situation, who is not susceptible to the approval of his fellow-man. I have yet failed to see the man, who is worth calling a man, who does not put forth his best efforts under the approval of his fellow-men. And the severest criticism that can come to any man is not to find fault with him, but not to notice him at all.—Schwab.

Changed Hands.—John T. Hepburn, Limited, of Toronto, has taken over the plant of the Martin Pump & Machine Company, 47 Dawes Avenue. The intention is to manufacture Hepburn special shell lathes for the present, and later a complete line of steam and water pumps.

New Plant of the Fred Thompson Co., Montreal

Growth and Development of the Electrical Business and the Increasing Demand for All Sorts of Equipment Has Brought With it the Necessity for Greater Buildings to Handle the Work

FEW activities of the present have shown such remarkable developments as that of electrical industry. Much of this expansion has resulted through the agitation for greater fuel conservation, so that many firms in the electrical branches have required additional plant facilities to handle the increasing business. The Montreal firm of Fred Thompson Company Limited, one of the oldest and best known in the electrical industry throughout the Dominion, has recently erected and occupied a new three-story factory on Genevieve St., a short distance from their previous location on Craig Street, where they had been carrying on business for the past nineteen years. This firm had its origin in 1894, being first founded by Fred Thompson, a pioneer in the electrical business. Mr. Thompson came to Montreal in 1882 and held the position of chief electrician with the old "Royal" Electric Company, for nearly twelve years. The initial office of the present firm was located in a small room of the old Temple Building on St. James St. Under the capable leadership of its present head the company had a steady expansion, the culmination being the recently well equipped and modern establishment.

NEW PLANT OF FRED THOMPSON CO., MONTREAL. SECOND FLOOR WITH OFFICES IN THE REAR.

A Well Built Place

The new three-storey and basement building has a total floor space of over 30,000 square feet, and is of brick and concrete fireproof mill construction, well lighted from three sides with metal sash windows. Fire doors are provided on the floor level of each stairway, each door fitted with fusible links. The various floors are arranged to accommodate the different departments to the best advantage, facilities being provided to handle the work rapidly and economically. The top floor is fitted out as a drafting and designing room, storeroom, pattern room, transformer department, and the coil making department. The front section of the second floor is reserved for the general and private offices, while the back portion is equipped for repairs and testing of the smaller electrical equipment; here all general repairs, winding, assembling and testing are carried on. A portion of this floor is set aside for impregnating and baking of the parts. Located on the concrete floors are the dipping and impregnating tanks and the electrically heated baking ovens, with an overhead travelling crane that handles all motor parts, heavy coils, etc., between the tanks and the ovens. This department with the switchboards and accessories is amply provided with the necessary facilities for testing at all voltages and also at any of the frequencies desired on alternating current, and also at any of the required voltages on direct current equipment.

NEW PLANT OF FRED THOMPSON CO., MONTREAL. GROUND FLOOR WITH SECTION OF MACHINE SHOP TO RIGHT.

The receiving and shipping room is located on the ground floor, also the general show room, conveniently arranged for the display o fall new and ready-for-sale second-hand machinery. The rear portion of this floor is reserved for the machine shop, and a general repairing and assembling department for the heavier equipment. In the basement are located the presses and machines for punching and cutting the discs for the stators and rotors, and also for the induction motors manufactured by the firm. Storage space is also provided for second-hand machinery, motor castings, pulleys, heavy hardware, etc.; also the heating apparatus.

Each floor is provided with overhead runways for portable chain blocks to facilitate the handling of the work. A Turnbull freight elevator operates from the basement to the top floor to transfer material from one department to another. Accommodation in the way of wash rooms and toilets is provided for the workmen.

This company makes a specialty of electrical repairs of every description—from fan motors to the largest electrical units now in use. They also manufacture induction motors up to 25 h.p. capacity and expect in the near future to enlarge in this connection. They design and construct electrical equipment of all kinds, transformers, magnetic apparatus, coils, etc., for special purposes. They buy, sell and exchange new and second-hand electric motors, generators, etc., guaranteeing all repairs that go through their factory. The new factory was designed and constructed by Jas. H. Hunter of Montreal. The present officers of the company which was incorporated as a joint stock company in 1913, are: Fred Thompson, president and general manager; Clarence Thompson, vice-president and secretary-treasurer; H. A. McPhee, superintendent; A. Walker, and J. B. Lacroix, electrical engineers.

NOTHING LIKE SYSTEM

"Don't tell me you can't remember things!" said Tom to John. "Memory is all a matter of system. Now, in what year was the battle of Agincourt fought?"

John pleaded that his memory failed him on that interesting historical fact.

"Exactly!" replied Tom. Now, how many days are there in a week?"

"Seven," came the answer.

"Very well. Twice seven is fourteen. Multiply by a hundred—fourteen hundred. Number of days in June, thirty. Half of thirty, fifteen. Fifteen and fourteen hundred?"

"Fourteen hundred and fifteen," murmured John.

"Right! That's the year the battle was fought. System, my boy, That's what does it—System."

AN UNSOPHISTICATED WITNESS

On a recent public occasion Chas. M. Schwab had occasion to refer to the coaching of witnesses and told of a foreman who worked for him once, who had come to Washington to appear before a committee that was investigating something. "I thought I had him pretty well coached; I thought I had him well trained what to say. I sat in the corner and watched him and presently found that he was straying a little from the training, and I shook my head at him, and in old-fashioned mill style he looked at me and said, "Well, damn it, Charlie, that's what you told me to say."

DESCRIPTION OF LIBERTY MOTOR AS AUTHORIZED BY WAR DEPARTMENT

The War Department authorizes the following statement :

The designs of the parts of the Liberty engine were based on the following:

Cylinders—The designers of the cylinders for the Liberty engine followed the practice used in the German Mercedes, English Rolls-Royce, French Lorraine-Dietrich, and Italian Isotta Fraschini before the war and during the war. The cylinders are made of steel inner shells surrounded by pressed-steel water jackets. The Packard Company by long experiment had developed a method of applying these steel water jackets.

The valve cages are drop forgings welded into the cylinder head. The principal departure from European practice is in the location of the holding-down flange, which is several inches above the mouth of the cylinder, and the unique method of manufacture evolved by the Ford Company. The output is now approximately 1,700 cylinder forgings per day.

Camshaft and Valve Mechanism Above Cylinder Heads—The design of the above is based on the Mercedes, but was improved for automatic lubrication without wasting oil by the Packard Motor Car Company.

Camshaft Drive—The camshaft drive was copied almost entirely from the Hall-Scott motor; in fact several of the gears used in the first sample engines were supplied by the Hall-Scott Motor Car Company. This type of drive is used by Mercedes, Hispano-Suiza, and others.

Angle Between Cylinders—In the Liberty the included angle between the cylinders is 45 degrees; in all other existing 12-cylinder engines it is 60 degrees. This feature is new with the Liberty engine, and was adopted for the purpose of bringing each row of cylinders nearer the vertical and closer together, so as to save width and head resistance. By the narrow angle greater strength is given to the crankcase and vibration is reduced.

Electric Generator and Ignition—A Delco ignition system is used. It was especially designed for the Liberty engine to save weight and to meet the special conditions due to firing 12 cylinders with an included angle of 45 degrees.

Pistons—The pistons of the Liberty engine are of Hall-Scott design.

Connecting Rods—Forked or straddle-type connecting rods, first used on the French DeDion car and the Cadillac motor car in this country, are used.

Crankshaft—Crankshaft design followed the standard 12-cylinder practice, except as to oiling. Crankcase follows standard practice. The 45-degree angle and the flange location on the cylinders made possible a very strong box section.

Lubrication—The first system of lubrication followed the German practice of using one pump to keep the crankcase empty, delivering into an outside reservoir, and another pump to force oil under pressure to the main crankshaft bearings. This lubrication system also followed the German practice in allowing the overflow in the main bearings to travel out the face of the crank cheeks to a scupper which collected this excess for crankpin lubrication. This is very economical in the use of oil and is still the German standard practice.

The present system is similar to the first practice, except that the oil, while under pressure, is not only fed to main bearings but through holes inside the crank cheeks to crankpins, instead of feeding these crankpins through scuppers. The difference between the two oiling systems consists of carrying oil for the crankpins through a hole inside the crank cheek instead of up the outside face of the crank cheek.

Propeller Hub—The Hall-Scott propeller-hub design was adapted to the power of the Liberty engine.

Water Pump—The Packard type of water pump was adapted to the Liberty.

Carburetor—A carburetor was developed by the Zenith Company for the Liberty Engine.

Bore and Stroke—The bore and stroke of the Liberty engine is 5 by 7 inches, the same as the Hall-Scott A-5 and A-7 engines, and as in the Hall-Scott 12-cylinder engine.

Remarks—The idea of developing Liberty engines of 4, 6, 8 and 12 cylinders with the above characteristics was first thought of about May 25, 1917. The idea was developed in conference with representatives of the British and French missions, May 28 to June 1, and was submitted in the form of sketches at a joint meeting of the Aircraft (Production) Board and the Joint Army and Navy Technical Board, June 4. The first sample was an 8-cylinder model, delivered to the Bureau of Standards, July 3, 1917. The 8-cylinder model, however, was never put into production, as advices from France indicated that demands for increased power should make the 8-cylinder model obsolete before it could be produced.

Work was then concentrated on the 12-cylinder engine, and one of the experimental engines passed the 50-hour test August 25, 1917.

After the preliminary drawings were made, engineers from the leading engine builders were brought to the Bureau of Standards, where they inspected the new designs and made suggestions, most of which were incorporated in the final design. At the same time expert production men were making suggestions that would facilitate production.

The Liberty 12-cylinder engine passed the 50-hour test, showing, as the official report of August 25, 1917, records, "that the fundamental construction is such that very satisfactory service with a long life and high order of efficiency will be given by this power plant, and that the design has passed from the experimental stage into the field of proven engines."

How the Vickers Co. Have Turned Out War Material

Makers of a Great Variety of War Material—Secrecy of Methods in the Old Land is Giving Way to Well Placed and Directed Publicity by the Authorities

IN the earlier part of the war considerable secrecy was insisted on by the various governments respecting the activity of the numerous industries contributing to the war effort. As developments proceeded apace it latterly became apparent that much benefit in the way of moral support and stimulation of output would result from judicious publicity regarding some of the spectacular and novel features of the situation.

One of the most pleasing features has been the constant frequency with which the King and Queen have visited numerous factories, mills, mines and explosives works throughout England and Scotland, resulting indirectly in much public interest in the plants visited. As a result of such events a number of photographs were recently published by "Engineering," of London, Eng., showing some departments of national and privately-owned establishments which had been visited by their Majesties.

Howitzer Production

The well-known Vickers' concern

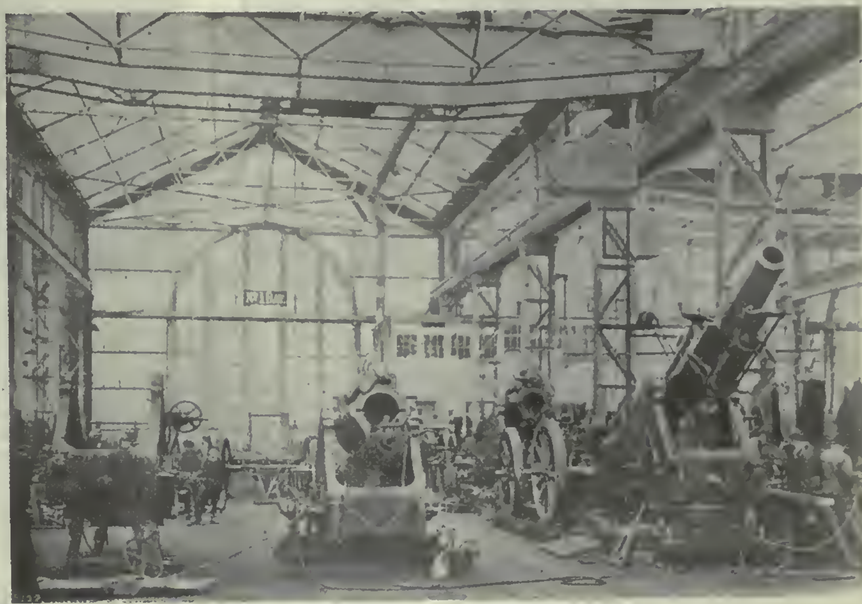


FIG. 1—ONE OF THE FIFTEEN BAYS AT THE NEW HOWITZER SHOP OF THE VICKERS' COMPANY IN ENGLAND.

FIG. 5—VIEW OF ONE OF EIGHT BAYS OF A LARGE SHELL SHOP FIVE MONTHS AFTER THE SITE WAS OCCUPIED.

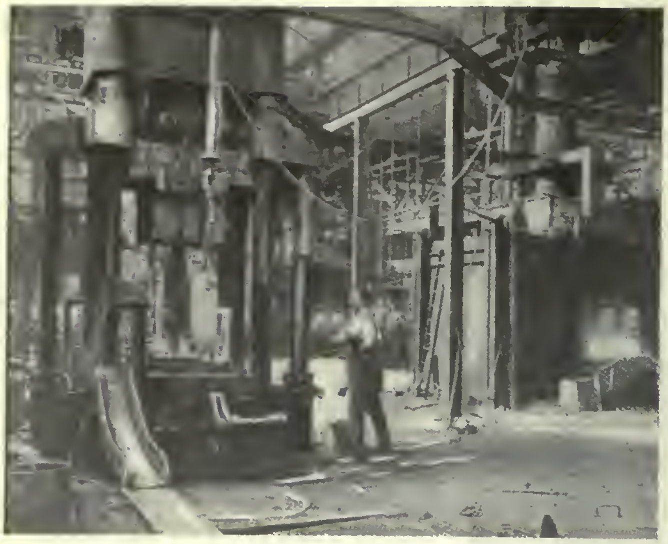


FIG. 6—FORGING 9.2 IN. SHELLS IN A BRITISH NATIONAL PROJECTILE FACTORY.

FIG. 7—WOMEN PRESSING BANDS ON 9.2 IN. SHELLS IN A BRITISH NATIONAL PROJECTILE FACTORY.

occupies a prominent place in the munitions world and a view of an entirely new howitzer shop at one of their establishments is shown in Fig. 1, while representative howitzers built there are shown in Figs. 2, and 4.

The building of this howitzer shop was commenced in August, 1915, the site being a private wooded park, and the building, which is admirably designed and completed in a thoroughly permanent character, has an area of 172,000 sq. ft., made up of 15 bays, all of uniform dimensions and equipped with specially designed plant and machines for the manufacture of the various units of howitzers.

When construction was started the firm guaranteed a certain monthly output in August, 1916, but the building was so quickly erected and the plant installed that the original output was exceeded within nine months of the site being taken over by the builders. Since then a considerable part of the field and howitzer equipment of the British army has originated in this shop.

Much of the important work, even in this department, is carried out by women machine workers under the supervision of male trained experts, who by this broad-minded action are performing a loyal service to their country. A certain small proportion of the men, however, take a narrow view on the question of labor dilution and endeavor to support their views by aggressive action.

It is not permitted to enter into detail regarding the design of the weapons produced, but the views shown are largely self-explanatory.

A Prominent Plant

Illustration Fig. 6 shows the interior of one of eight bays of a large shell shop which was erected by the Vickers' firm immediately after the outbreak of war. Commencing the foundation work in October, 1914, the plant had a considerable output of large-size shell in the spring of 1915. Fig. 6 was taken five months after the site was occupied.

The eight bays are each 60 ft. wide and from 400 to 475 ft. in length, and include a gallery 270 ft. long where the smaller shells are manufactured entirely by female labor.

A feature of the work done at this plant was the remarkable variety of shells turned out. This statement is not made in disparagement of highly specialized plants, but was due to the fact that the company, having a completely experienced staff prior to the war, was able to give, for the benefit of new-coming firms, the nucleus of new shell-manufacturing staffs, and in this way their indirect services were of as much influence as the direct production of shells.

National Projectile Factories

Figs. 6 and 7 are two views in a National projectile factory. The plant illustrated was commenced in September, 1915, and delivered the first shell in the following March. There are 20 bays of similar construction ranging in length from 600 ft. to 925 ft., and in width from 50 ft. to 38 ft. The total area of the plant is 37¼ acres, of which 12¾ acres are covered by buildings.

A self-contained power plant had to be provided of 6,000 horse power to provide hydraulic power for the forging presses, electricity for light and power, and compressed air for the pneumatic tools. Owing to the predominance of women workers every machine tool is fitted with a crane to reduce fatigue of operation to the lowest point. A very complete system of transportation is installed, while the trackage of industrial railway throughout the shops exceeds three miles.

National shell-filling factories followed as a natural sequence and the Vickers. Co. participated in this work largely. The plant referred to has a total area of 400 acres, the buildings alone covering over 1,000,000 sq. ft. Within the works are 11 miles of railway, while 3½ miles of timber runways were constructed to obviate the necessity of the workers going across open ground and running the risk of entering buildings with grit on their boots.

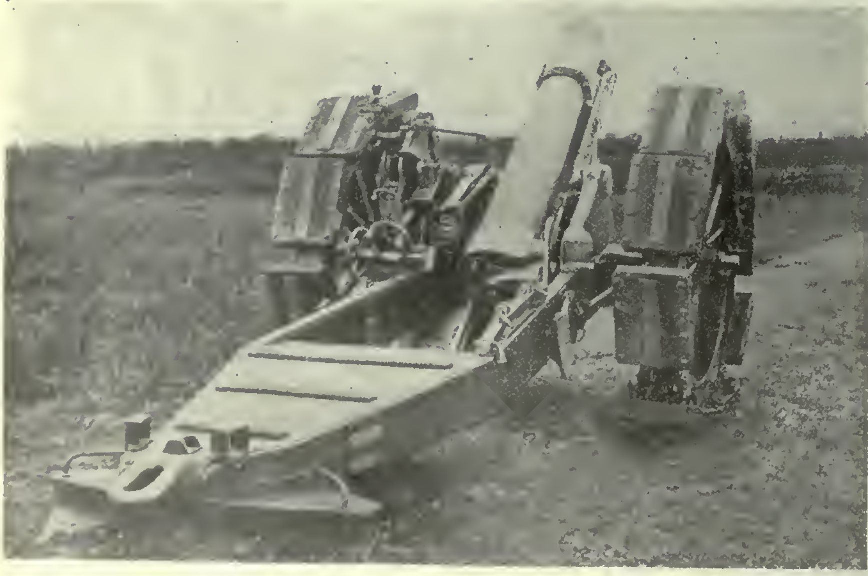


FIG. 3—6 IN. BRITISH HOWITZER.

Germans Are Ignorant of What Is Happening

Captain Len Morrison Spent Two Years in a German Prison Camp —Says Civilian Population is Suffering From Lack of Necessities —In France Early in 1915

THE following details of the treatment accorded to prisoners in Germany given to CANADIAN MACHINERY by Captain Len Morrison of Toronto, who was repatriated and arrived home last week, does not improve one's appreciation of German kultur. Captain Morrison as an officer received much better treatment than is accorded hundreds of thousands of other prisoners, and while he did not see how these other men were used he heard many accounts of almost unbelievable cruelty. Captain Morrison is a son of James Morrison of the Jas. Morrison Brass Mfg. Co., Ltd., of Toronto.

He was in England taking part in the shooting at Bisley when war was declared and at once made application to enlist for active service. He was advised by the British authorities to return to Canada at once and join his own regiment, the 10th Royal Grenadiers. He at once cabled his services to Col. Brock, the O. C. of the Grenadiers, and soon after arriving in Canada was sent to Valcartier and from there to England.

Hit at Ypres

He was sent to France early in February of 1915 and at the second battle of Ypres, in which the Canadians lost so heavily, was sent up to the firing line in charge of reinforcements for the 13th Battalion. Owing to conditions he was unable to connect with that unit and while battling with the Germans in a trench into which he had ordered his men, was struck by a machine gun bullet in the right leg just above the knee. A compound fracture resulted and the bullet passed on and injured the left leg also.

While Captain Morrison was having his injury dressed by a soldier the man looked up and saw the Germans coming and at once took to his heels. Just about this time the British artillery opened a heavy fire on the advancing Germans. Captain Morrison was caught in this and was frequently covered by the dirt thrown up when shells burst, but escaped serious injury. He dragged himself along, slowly and painfully, until he found a more sheltered place and then, after fixing up his wounds as best he could, waited. It was 36 hours before he was picked up by a party of Germans.

CAPTAIN LEN MORRISON

Saxons All Right

"I was fortunate at first in falling into the hands of Saxons," said Captain Morrison. "The Bavarian troops are very rough and the Prussians even worse. When I saw the party coming I just shut my eyes and waited for the worst, not knowing into whose hands I was going to fall. The men, although they were in a hurry, treated me kindly enough and carried me to a sheltered spot and after putting a rubber sheet under me, put another one over me and a greatcoat on top of that and left me. It was a good thing they had fixed me up as it commenced to rain and came down pretty heavy nearly all night. Next morning one of the Saxons, a young private, gave me his own ration of coffee and bread. I gave him some cigarettes. Soon after a medical officer came and my wounds were attended to and I was sent to a rail head. Here I was placed in charge of a young officer who could speak excellent English. He told me he had been in New York when the war started, and when I told him I was from Toronto he said he had been there.

Gloated Over It

"Soon after the officer had left me and while I was waiting to be lifted on the train, I had my first experience of German kultur. I was quite helpless as far as my legs were concerned and a German soldier who had been watching me came over and kicked my leg as hard as he could. Fortunately he kicked the left leg, which was not fractured. In order to deceive him I made

FIG. 2—9.2 IN. HOWITZER ON SIEGE MOUNTING.

FIG. 4—9.2 IN. FIELD HOWITZER.

a face as though he had hurt me badly and he went away in great glee."

Captain Morrison was taken to the hospital at Ghent, where he spent six months and was well treated. As soon as he was able to get around he was transferred to the Craefeld Prison Camp, in Westphalia. This is only eighteen miles from the Holland border and as attempts to escape are made almost every night the discipline is severe. There were 1,200 prisoners there when Captain Morrison arrived, of whom 300 were British officers. One of the first things he noticed was the manner in which the German military authorities keep the people in the dark as to what is happening in the outside world. The prisoners were permitted to have the German newspapers and translations of the news was made by officers who were able to read German. The news was obviously all carefully gone through before it was allowed to be published and everything that was in the nature of a German success was made the most of while reverses of any kind were not mentioned.

People in the Dark

"The whole policy," said Captain Morrison, "is to keep the people in ignorance of what is happening They were fed up on tales of the prodigious successes of the German armies."

One of the plans of the military authorities is to keep the prisoners moving. Captain Morrison was not kept at any of the prison camps for any length of time. The reason probably is that when the men become familiar with their surroundings they have a better chance to escape. The worst prison camps in Germany are in Hanover, and it was to one of these that Captain Morrison was soon sent.

"We were given such short notice that we were to be moved," he said, "that many had to leave without even a chance to get together their belongings. Many of the officers under the impression that they might stay at Craefeld for some little time had from their own private funds fixed up their quarters by having them repapered and additional furniture moved in. They were rather rudely surprised at being given no chance to even get things they needed. We were simply rounded up into parties and told we were to be moved and had to wait until the authorities were ready to move us, which wasn't long. From Craefeld I was taken to Schwarmstedt, and after a couple of weeks there was taken to Holzminden. Both these camps are in Hanover. The sand which surrounds the quarters is full of fleas and the sanitary arrangements were very bad. The beds were full of vermin and the heat was something terrific. While we were allowed to make protests regarding conditions absolutely no notice was taken of them. We had to do our own washing and cooking with the scantiest of appliances. Many of the men suffered greatly and there was a great deal of sickness. One of the common things which results from being kept in a German prison camp very long is loss of memory. Up to this time we had been able to get a fair variety of food, but it was not long before conditions in Germany began to be felt in our camps. At Holzminden each morning we were given coffee made out of acorns and unpalatable stuff. At noon and in the evening we each got a bowl of soup which was made from some kind of weeds and was anything but inviting. These camps are known as strafe or punishment camps and they certainly are well named."

Some More Kultur

At Holzminden the camp commandant was Captain Neimyer and his one mission in life, according to Captain Morrison is to go around and make things miserable for the prisoners.

"Nothing would satisfy him," said Captain Morrison; "his one idea was to roam around looking for trouble. The heat was terrific but he decided that it would be most unwise to allow the windows to be open at nights. The mattresses on which we had to sleep were very dirty, so between Captain Neimyer, the hot weather, poor food, the fleas and other troubles we suffered considerably. This, of course, pleased the captain. We had to take our bath in the horse trough and had no soap.

"People in this country who think the war has affected them have no idea at all of what the people in Germany are enduring. Everything is being sacrificed for the needs of the army. There is such a scarcity of leather that the majority of civilians now wear either wooden shoes or shoes with a flexible steel sole. Clothing is very scarce and high priced. Food is the worst, though. The Germans who are not fighting fare very badly. Our sentries were generally old men unfitted for active service and I have often seen them go to the garbage piles in the camps and endeavor to scrape out from tins which had reached us through the Red Cross little scraps of fats or grease. Not infrequently loaves of bread which had been sent to us would reach us in a blue, mouldy condition from delays in transmission. It was unfit for us to eat and when we threw it away the loaves would be eagerly taken by these men. "While we were not allowed to mingle with the civilians, we could judge of conditions from the walks we were permitted to take on giving our parole not to attempt to escape. There was unmistakable evidence in the pinched faces of the people, their tattered clothes, the wan and sickly looks of the women and children that they were being deprived of the essentials of life.

"It is this sort of thing that is weakening the courage of the German people. When they find out what they have been compelled to suffer and how they have been misled by the militarists there will be a great reckoning."

From Holzminden Captain Morrison was sent to Heidelberg and on account of his physical condition arrangements were made to send him to Switzerland. With 90 others he left Heidelberg at 3 o'clock in the morning and was taken across the border. From then on all was smooth sailing and he was sent from there to England and from there home.

"GARABED" THEORY IS SHOT TO PIECES

Commission Don't Give Him Any Encouragement Following His Demonstration

A matter that was attracting considerable attention by engineers and scientists has been settled. A representative body of men representative of the best that United States has in the way of research and technical knowledge, have decided that the "Garabed" principle is not sound. The finding they have handed out is put in very lenient words.

For a time after the tests were made there was a bit of hope that there might be a favorable report on the case, but that was entirely dissipated when the official report came out in the Official Bulletin published at Washington. The report does not give Mr. Giragossian much hope of further encouragement. Nothing has come out to show exactly on what principles he was working. In fact the secrecy in which he was working is carried out in the report issued by the Department of Interior. It could hardly say less and say anything at all.

Following is the official signed report:

We, the undersigned, who are members of the commission duly appointed in accordance with the provisions of public resolution No. 21, Sixty-fifth Congress, hereby certify that Mr. Garabed T. K. Giragossian showed us on Saturday, June 29, 1918, a model embodying the principles of his invention known as the "Garabed." We found that the model was not in shape to run or develop power. The inventor admitted that he had no working machine and that he was merely explaining principles. We do not believe that his principles are sound, that his device is operative, or that it can result in the practical development or utilization of free energy.

Witness our signatures at Boston, Mass., this 29th day of June, 1918.

James A. Moyer, director, Massachusetts State Board of Education.

Edward F. Miller, Massachusetts Institute of Technology.

M. de Kay Thompson, Massachusetts Institute of Technology.

Edwin B. Wilson, Massachusetts Institute of Technology.

Hamilton, Ont.—The E. T. Wright Co., of Hamilton are contemplating the erection of a 150 ft. by 56 ft., one story and basement addition, to their present factory. The building will be so constructed as to permit of further extension should occasion require.

Repeated Impact Test Gives the Best Results

Various Devices Have Been Brought Out to Secure Accurate Temperature Control — Dr. Stanton Has Done Some Valuable Work in This Connection—A Wide Field in Which to Experiment

CLOSELY connected with the question of heat treatment is the subject of mechanical tests upon the treated material. Attention has been recently directed to the very great importance

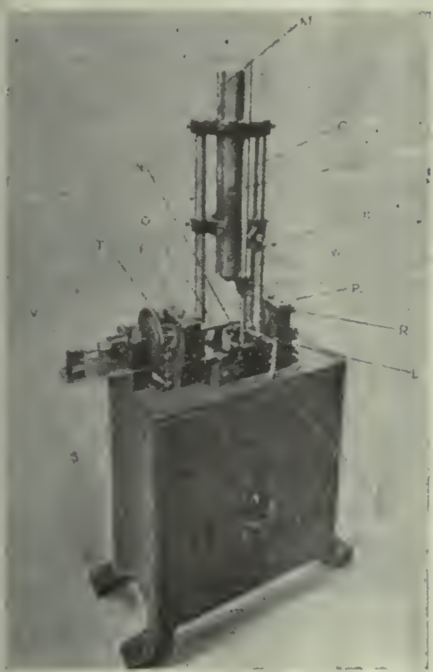


FIG. 4.

of such mechanical tests. It is not proposed here to enter deeply into the question of hardness tests, but experience suggests that the form of test most frequently used does not necessarily indicate what will be the resistance of the hardened surface to the abrasion to be met with in ordinary wear. In those tests which base the measurement upon the rebound of a weight from the hardened surface it appears possible that the mass of the hardened piece enters into the measurement, and it is suggested that figures attained in this manner should be regarded primarily as comparative between pieces of the same mass. Of course it is very clearly recognized that this comparative information is extremely valuable and these remarks are only made as a suggestion for further investigation.

A variety of tests are now made upon materials used in engineering work—for instance, tensile strength, elastic limit and yield point. There is also the single impact test, for instance, the izod test. It is found, however, that when you have all the data which these tests can give that there may exist large and critical differences between two materials, whose tests are apparently the same, when these materials are subjected to actual use in a piece of mechanism.

To discover such differences, the repeated impact test is extremely valuable. It is probably well known that Dr. Stanton devised a machine for making such repeated impact tests in 1908, and experiments with his machine have shown that extremely valuable information can be obtained by subjecting the material to a succession of shocks or impacts of a known amount, each shock being small individually, but the cumulative effect resulting in the breakage of the sample.

In the various forms in which this repeated impact testing has been worked out certain disadvantages were found with regard to the detail arrangement of the mehcanism. For instance, in one form it was found that the energy of the blow was not strictly calculable because it was uncertain how much mass was operating. The hammer which delivered the blow was attached by a lever, and it was impossible to calculate exactly how much of this lever entered into the effective mass of the hammer. It was further found that the nature of the surface upon which the machine was mounted influenced to a large extent the resulting figures.

Repeated Impact Testing Machine

To get over these difficulties, Mr. C. G. Eden worked out a design of repeated impact machine, and in conjunction with him I have developed the machine illustrated in Fig. 4. The hammer is without attachments, and falls freely under the influence of gravity, the whole falling mass of the hammer is symmetrically disposed above the point of impact, and the actual height of the fall may be measured easily, so that the true energy of the blows is calculable to a high degree of accuracy.

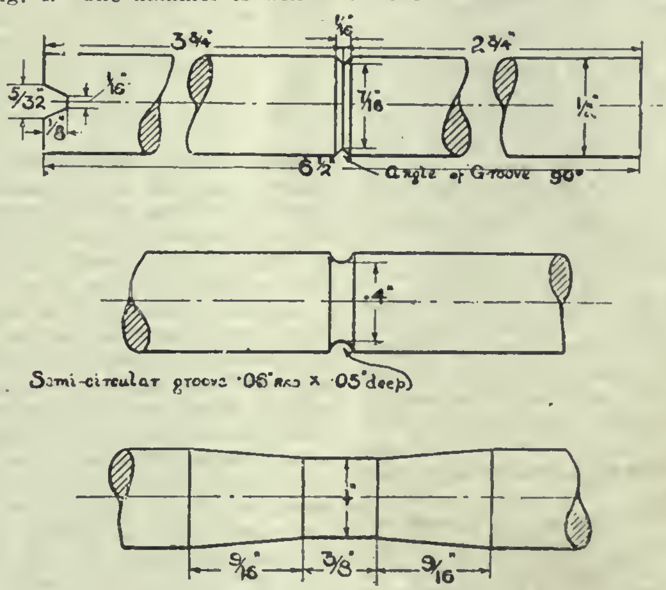


FIG. 4.

The base, which supports the test-piece, is massive and rigid; it will therefore experience only a negligible movement or deflection during the time in which the falling hammer delivers its blow. For this reason it is immaterial to the results attained whether the machine be mounted on a concrete floor or a wooden bench.

To demonstrate this feature of the design, the tests tabulated below were made under extreme conditions. In the first two tests, marked "rigid," the machine was firmly bolted down on a concrete floor, while in the remaining two, marked "floating," the machine was loosely supported upon a bed of folded canvas strips five inches wide, set up on edge. This last condition was the most non-rigid mounting that could be contrived. The material tested was an alloy steel, the samples being cut from the bar as it came from the mill and not subjected to any heat treatment. It will be seen that, notwithstanding the extreme conditions of mounting, the results are in very fair agreement.

Sample No.	Condition of Machine	Number of Impact Blows	Dep. from mean (1138 blows)	
1	Rigid	1104	— 34	— 3.0%
2	Rigid	1120	— 18	— 1.6%
3	Floating	1186	+ 48	+ 4.2%
4	Floating	1142	+ 4	+ 0.4%

The illustration in Fig. 4 gives a general idea of the external appearance of the machine. The whole of the mechanism is secured to and supported by the main casting, which also acts as a cover to the tank or box casting. Projecting through the side of the tank, but not seen in the ilustration, is the main spindle. This may be driven by a 1-in. belt from any convenient countershaft, or alternatively by an electric motor with suitable gear or worm reduction. The power required is about one-tenth horse-power.

Mechanism

The main spindle carries a dog clutch normally in engagement and driving a cam. A roller bears on the upper surface of the cam and is attached to the lower end of the rod H. It is so guided that it rises and descends at each rotation of the cam. Fixed on the rod H is an arm J, which engages with the lower face of the hamer M, thus when the rod H rises, by rotation of the cam, the hammer M is also lifted. The hammer slides freely between two sets of three-point guiding screws, these screws being carried by the two castings seen attached to the standard G and its fellow on the opposite side.

Mounted upon the standard G is a sleeve W, free to rotate about the standard but normally held in a fixed position by the spring L. Clamped on the sleeve W is an adjustable catch K. As soon as the arm J has lifted the hammer M sufficiently, the spring L causes a partial rotation of the sleeve W, so that when the arm J descends, the hammer is held by the catch K. The lower inclined face in engagement with the roller arm N, attached to the sleeve further descent of the arm J brings its W. in such a manner that the catch K releases the hammer M, allowing it to fall upon the test-piece O.

The test-piece, the size and details of which are further discussed below, is carried by two hardened steel bushes in the plummer blocks PP. It is rotated through 180 deg. between successive blows. One end of the sample is slotted to engage with a universal joint drive, and is kept in engagement by a screw R. The universal joint is driven through a free wheel and clutch T by the chain S. One end of the chain is attached to the roller bearing on the cam already described, and the other end carries a weight suitably guided; the rotation of the test-piece begins and ends entirely between the successive blows.

The revolutions of the test-piece are recorded by a counter V. and of course, the number of blows is found by multiplying the counter record by two. When the test-piece breaks it comes in contact with an arm X, and thereby trips the clutch and stops the machine. The tank is partially filled with oil to provide efficient lubrication of the cam and other surfaces.

The hammer is shod with a tup of hardened tool steel. The height of the drop depends on the position of the adjustable catch K on the sleeve W, and may be varied from one to four and a half inches (25 to 113 m/m). To allow a wide range of tests, two hammers are provided, weighing 5 lbs. and 2 lbs. (2.26 and 0.91 kilos) strength.

Using the 5 lbs. hammer, the main spindle may be driven at any speed up to about 60 revolutions, or with the 2 lbs. hammer up to about 90 revolutions per minute, giving 60 and 90 blows per minute respectively.

Test Pieces

The machine is adapted for test-pieces of dimensions similar to those adopted by Dr. Stanton; these are illustrated in the upper diagram in Fig. 2. It will be seen that a V notch is cut in the region of impact to localise the stresses. The angle at the bottom is 90°, and is made as sharp as possible. As an alternative, a semicircular groove, as shown in the middle diagram of Fig. 5 may be used, and such a groove appears to offer several practical advantages over the V groove. Referring to the upper diagram in Fig. 2, it may be assumed that the action of the hammer, when it falls upon the test-piece, is to produce a very slight but sudden bending at the section of smallest diameter, that is, at the bottom of the groove, as indicated diagrammatically in Fig. 3. This will produce an area of compression at "A," and will tend to start slipping between the crystals, due to tension, at "B." Of course the process is reversed at the next blow because the test-piece has been turned through 180° in the meantime.

It will be admitted that it is quite impossible to turn a groove having a true

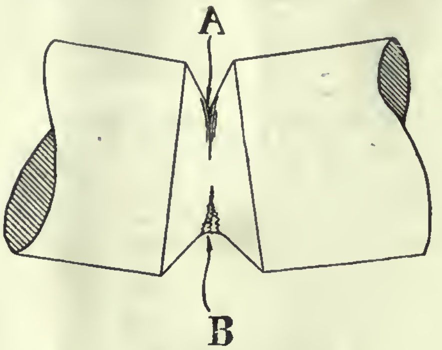


FIG. 5.

geometric angle, there must be some minute curve at the bottom of the groove. The size of this curve will determine the axial extent of the regions of compressive and tensile stresses. Since this size is in any case very small with a nominally sharp V, it is obvious that the variation between the size of curve in different test-pieces will be relatively large and will tend to introduce an element of uncertainty into the test results. It may be argued, in addition, that since no capable engineer would design a machine with a sharp re-entrant angle the conditions of test are largely artificial.

Another shape of sample has been proposed, as shown in the lower diagram of Fig. 2, having a relatively large portion of reduced diameter, but this is not advised. The end of the tup of the hammer, being a plane surface, will bear upon the test-piece over a considerable length parallel to the axis of the test-piece, and it is probable that, owing to the minute bending of the sample, the local stresses at the ends of the area of contact are greater than at the plane equi-distant between the points of support—in fact, it has been found with test-pieces of this shape fracture will begin at the point coinciding with the end of the area of contact between the tup and the test-piece. There is a further disadvantage that the action of the blow will distort the cross section of the material at the plane of fracture.

The semi-circular groove, as shown in the middle diagram in Fig. 2, is free from the disadvantages of both of the other types. It serves to locate the plane of fracture sufficiently closely, the effective diameter at the bottom of the groove is measured easily, any small departure from the nominal curvature is without practical effect upon the results and the actual area of fracture is not distorted by the hammer blows. Re-entrant angles are frequently designed in machines with a fillet of such radius, therefore the results have a more direct bearing on actual engineering practice.

The following tests were made to investigate the effect of the shape of the groove. The material was a commercial mild steel, annealed by heating to 900° C. and cooling in the furnace. The tests, as a whole, demonstrate the relatively unreliable nature of commercial mild steel. They show clearly, however, the greater approach to uniformity with the semi-circular groove, they also show the small influence of large variations in the curvature of the groove.

Sample No.	Diam. at bottom of groove. inches	Shape of Groove.	Radius of Grove. inches	Number of Imp. Blows
3	0.400	Sharp "V"	——	8
4	0.400	Sharp "V"	——	188
5	0.400	Sharp "V"	——	260
6	0.400	Sharp "V"	——	70
7	0.400	Semi-circular	0.06	548
8	0.400	Semi-circular	0.06	590
9	0.400	Semi-circular	0.04	410
10	0.400	Semi-circular	0.04	484

As an indication of the valuable information to be obtained with this repeated impact machine, the summary of tests in the table below is interesting.

Mater.	Izod Impact Ft. lbs.			Eden-Foster Repeated Impact No. of Blows.		
	Max.	Min.	Mean	Max.	Min.	Mean
A	104.7	90.7	97.7	584	458	521
B	71.7	45.0	58.4	1478	782	1140

These results show that the "Izod" test does not, by itself, give a reliable indication of the dynamic respectively.

MAY TRANSFER ROYAL NAVAL COLLEGE

THAT the decision has been practically reached to transfer the Royal Naval College from Kingston, Ont., to Esquimalt, B.C., is the announcement made recently through the offices of the capt.-supt. of the Esquimalt dockyard. The naval college, which was removed to temporary quarters at Kingston following the disaster last December, is to be transferred here temporarily, pending the erection of new college buildings at Halifax. It was announced that the naval students will be accommodated in one of the large buildings available in the Esquimalt dock yards, which can easily be converted for the purpose. It is understood that the naval students will be installed at Esquimalt by August.

Method of Estimating Cost of Machine Work

The Manufacturer Cannot Continue to Stay in Business and Estimate Too Low—Some of the Irregularities That Come Into the Question of Figuring on Jobs For the Trade

By DONALD A. HAMPSON, ASSOC. MEM. A.S.M.E.

UNDER this heading a construction engineer relates his experience in getting bids on some castings and machine work. The work was for replacement on some hydraulic equipment for a large city; bids were asked from a dozen shops, nine of which quoted their hourly rates and the other three quoted prices of $750, $1,020 and $1,890. Evidently the wide variance in these three latter rather peeved the engineer for he goes on to say . . . "cannot take a drawing and make an estimate from it" . . . "when a job is taken to a contract shop, expect to be overcharged as a matter of course," . . . "small manufacturers with their inefficient methods," etc. Such remarks ought not to go unchallenged, and having been in the despised small manufacturer class I will present some of the points from the other side.

Afraid of Fair Price

It is an undeniable fact that many manufacturers and many machinists are unable to estimate the cost of a given piece of work; it is also true that many manufacturers (small ones only) are afraid to ask a fair price for their work in advance and to add a margin for safety to cover those little necessary uncertainties and losses which are reasonably sure to crop up. Without a doubt, the nine replies that named no price came from shops in this class, and it must be said from their standpoint that they were justified in quoting only hourly rates, while the shops themselves may have been run efficiently and the management been entirely honest.

The three bids of $750, $1,020 and $1,890 likewise may have been made with all honesty, the $1,020 bid probably representing a fair average price and the others extremes either way. It is easily probable that the difference in prices has come from different shop equipment and methods and different market prices for labor and materials in different localities. Such being the case, each shop bid a fair price and is justified in sticking to it. It is safe to assume that the fees of consulting engineers vary fully as much—yet the man with a Broadway suite is fully as honest and as capable as his struggling brother in the north-west whose bid is fifty per cent. less.

In the case that we are considering a complaint was made about the slowness with which the bids came in. It is easy to settle that and the answer sheds some light on the widely different prices, too. Many, many drawings do not state the limits which the machinist and the estimator must know, which denotes certain finishes and fits, and which are supplied with all the notes that any man, other than a mind reader, should have before an intelligent estimate can be made. Such shortcomings are to be expected on the drawings of inventors and laymen, but the work of engineering departments is open to criticism at times also as witness the following.

And in Three Days!

The largest steel and machinery firm in the U.S., outside of several trusts, found its plants overtaxed and decided to put several of its products out on contract. Our shop asked for a chance to bid on some of the work, and received a fifty pound roll of prints and a letter stating that "we must have your estimate in three days." The work amounted to a hundred thousand dollars, and could be spread out over seven months —the estimate though must be hustled. Imagine our surprise when an examination of the prints showed sixteen letters denoting sixteen different finishes, but no key to the finishes being shown on the prints. Hence we knew no limits and finishes except by guesswork. Further, steels and bronzes of special analyses were required, standard bolt and nuts were carefully detailed—presumably to be made up, though a dozen machine screw manufacturers kept them in stock—and even locks that could be found in hardware catalogues were detailed. What kind of an estimate could be made on such information? Only a few weeks ago an engineer asked us for a figure on forty-eight 15 in. cylinders, and his drawings failed to show a finish on the outside, which would add forty per cent. to the labor (a finish that we guessed he wanted, and that he really did).

All of which is not intended as a knock, but just to show that "much might be said on both sides," and that a spirit of tolerance and co-operation is of mutual advantage. I should have liked a chance to bid on the drawings which raised the question, but I contend that because my price was higher or lower than the others or the engineer's guess, it would not mean that any of us was wrong.

No Standard of Prices

There is such a thing as a fixed standard of accuracy which is good the world over, but no standard of prices, yet on work which is not made in quantities, two men on the same block might make widely different estimates, and both of them be correct for their own shop. It's all a matter of equipment and ingenuity on these jobs of a few pieces, modified by the local scale for commodities—cost systems and efficiency methods here count for but little if the shop force is well directed. System and the proper tools and large quantities will make the cost per piece the same in the East as in the West—but that's another game.

That first class shops "slip up" on this estimating problem may be proven by two instances. An Ohio manufacturer whose equipment and men have always been the best that money could get, and whose line was as near to shell work as any could be outside of the military field recently gave a talk before an engineering body, relating their experience on a shell contract in 1915, how their estimates were far too low, their deliveries six months behind, and unlooked for troubles all along the way. If first class men with every facility can't estimate duplicate work in big quantities is it fair to brand as inefficient small manufacturers who incorrectly estimate the time on a single piece? Another, an Eastern machine tool plant took on some contract work for an automobile concern. Both firms have a nation-wide reputation for good work, one in the small lathe field and the other in the $5,000 car field. The machine tool firm lost nearly 50 per cent. on their contract, presumably because they, too, "cannot take a drawing and estimate from it."

Defends the Machine Shop

There are many machinists that will resent the slur on contract and jobbing shops and their charges. Granted that there are unscrupulous men in the machine business as in every other, that there are city shops running in cellars that never see the light of day, and country shops doing business in converted barns with a junk pile supporting one outside wall (this combination known as the "foundry"), yet the majority of city and country shops are honestly run, and rank far above establishments in the building trades which do not come in for such slurs. One marked difference between the machine and building trades is that the former work the longer hours, under stricter supervision, must deliver of a skill and intelligence of a high order, and the shop and men get less per hour than in a branch where the entire "trade" can be learned in a month. The employer in the former case has to provide equipment of the most expensive and extensive kind. has to figure a job down to the last five cents, and is subjected to a multitude of useless factory laws that tempt him to sell out and put his money in the savings bank.

Yet, because the contract shop charges for the time it took to collect and put away tools and blocking, for the set-up on a single job, and for the six hours setting up as well as the two hours that it took for the actual cut, it is over-charging. I have had a man contend that, because he was charged the same for a cut .005 in. deep a for one ⅛ in. deep, he was overcharged, his contention being that the work was so much less in the one case.

Can't Figure Too Low

The facts in the matter are these: any small manufacturer is in business to stay if he can and he will meet his customers half way both in charges and estimates, but he cannot continue to figure too low and stay in business. Maybe the equipment of one shop is such that it can do boring to better advantage than any other kind of work, but the shop will take other work as it comes along and charge the usual rates for it by the hour, it cannot be expected to do this other work for the same price as a specialist in that particular line. The proprietor is honest and so is his loyal gang of men who work more minutes to the hour than any plumber who ever came down the pike, but to live they must at least break even on their work. I have had a painter complain about the brushes he had to buy for his men; his equipment ended with brushes and ladders, mine began with machine tools and high-speed steel and drills (and included brushes as a minor item) and yet in our locality working painters got 20 cents more an hour than machinists and charges for work were in proportion. If the small manufacturer got a little more of the $1 to $2 an hour work he wouldn't remain a small manufacturer long. Doctors and lawyers are entitled to their fees whether they win or lose —why should not machine shops get a fair price when they have to win to collect at all?

ECONOMIC STEP BY ENGINEERS

The Canadian Engineering Standards Committee, constituted with official representation from the departments of the government, the Canadian Manufacturers' Association and the important technichal organizations, has been formed in Montreal, and will be of paramount importance in economic production in Canada. It will also have the effect of harmonizing British and American practice. Its primary objects are to secure interchangeability of parts, to cheapen manufacture by the elimination of waste entailed in producing a multiplicity of designs for one and the same purpose, to effect improvement in workmanship and design, and by concentration rather than by diffusion of effort to expedite delivery and reduce maintenance charges, and storage.

At the organization meeting Sir John Kennedy, the dean of the engineering profession in Canada was unanimously appointed chairma, and P. H. Vaughan and Capt. R. J. Durley vice-chairmen. Dr. John Bonsall Porter was elected honorary secretary-treasurer, and Frank S. Keith, secretary. The headquarters of the organization will be at the Engineering Institute Building, 176 Mansfield street, Montreal.

THE INDIVIDUAL DRIVE BECOMING MORE POPULAR IN ENGLISH SHOPS

By P. E. R.

Individual motor drive for metal working tools is becoming standard practice and it is interesting to note some of the applications of electric drive as developed in England.

The drawing Fig. 1 shows a curve of a machine arranged for self-contained electric drive, single speed, through gearing and motor mounted on top of the machine. A strong cast iron framework is attached across the machine standards, and the whole driving gear is mounted on planed faces on this casting. A compound wound motor of 35 b. h. p. with starter is used to drive a 5-foot square machine to run at approximately 600 revolutions per minute.

The two gear wheels run in an enclosed oil bath and the two shafts are supported in self-oiling bearings, with provision for returning oil running out of same to the reservoir. The quick return of the table is operated by the motor shaft extension, so that the gears do actual work during the cutting stroke only. It will be noted that no crossed belt is necessary.

Fig. 2 shows a 5-foot square planing machine, fitted with an English electric planer equipment, while illustration Fig. 3 shows a 4-foot square planing machine to plane 10 feet long, fitted with a special four-speed countershaft, self contained electric drive, the motor being directly coupled to quick return shaft. The size of motor used with this machine is 20 b. h. p. compound wound, and runs at approximately 400 revolutions per minute.

It is said to be possible with this drive to obtain cutting speeds of approximately 30, 40, 50 and 60 feet per minute with a constant return speed of 90-100 feet per minute. All the bearings in this machine are self-oiling. Each turn of the hand wheel shown on the photograph gives a different cutting speed without stopping the machine. There is no unnecessary friction and no claw clutches. There are no sliding gears to break and no noisy gears, nor leaky gear boxes to drop oil on to work before the finishing cut is taken.

The accompanying curves Figs. 4 and 5 were taken with a Lancashire electric drive ,which is said to be economical in power and has a perfect regenerative and cushioning effect at reversal. On a belt-driven planer the reversal of the pulleys and the consequent slipping of the belt causes a large amount of power to be wasted at each reversal This waste becomes larger as the stroke is decreased.

In order to prove this the following tests have been taken on the two rack driven planers (1) A 5 ft. 6 in. x 3 ft. 6 in. x 12 ft. planer was arranged with motor belt drive and three flywheels for reducing the peak and assisting the reversal. (2) A 4 ft. x 4 ft. x 12 ft. planer was equipped with a "Lancashire" drive and in both cases the cutting speed was 50 ft. per minute and return speed 150 ft. per minute. The load on the bed slides in each test was 4 tons.

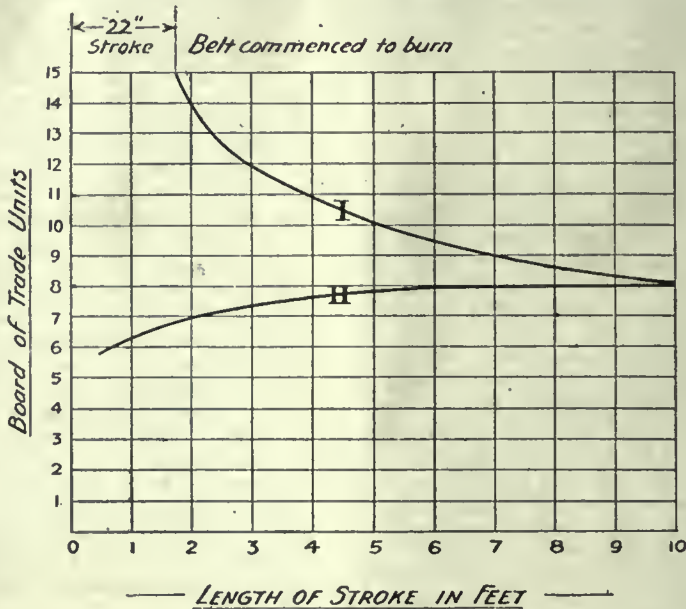


FIG. 1.

The test was made with a watt hour meter and the curves show the total power taken from the mains in both cases with various strokes. In the above tests the electrical machines were only partially loaded as the planers were not cutting, therefore under ordinary working conditions the efficiency of the "Lancashire" drive as compared with the belt drive would be still more pronounced.

F. W. Field, British Board of Trade Commissioner, has just completed a tour of all Ontario manufacturing centres.

FIG. 2—AN ENGLISH 5-FT. SQUARE PLANER FITTED WITH ELECTRIC DRIVE. INTERIOR OF MACHINE SHOP.

THE MANUFACTURE OF TACKS

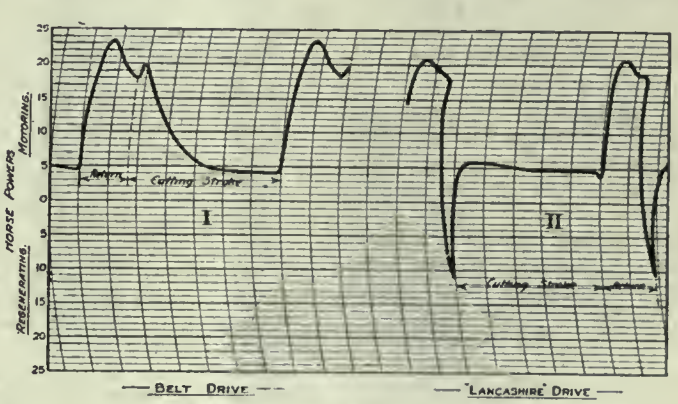
THE majority of users of the humble tack have no conception as to the amount of work involved in its production or the number of processes that are necessary to produce this common but very important article. To look at a tack one would hardly believe that so much expenditure of labor and skill was necessary in its manufacture, but in reality such is the case. The fact that tacks are manufactured in large quantities on a high-production basis enables the manufacturer to operate his plant profitably in spite of the low cost to the consumer. The amount of profit depends to a large extent upon the layout of the plant and methods employed. These methods, while being very similar in most plants vary in certain particulars which may be termed trade secrets. Most tack manufacturers have methods of their own which are carefully guarded and which are claimed to affect considerably the earning capacity of the plant and the quality of the product, both very important factors in these days of keen competition.

The tack plant which the Steel Company of Canada, Ltd., operates at its Canada works, Hamilton, Ont., is run on a highly efficient and profitable basis.

The company furthermore has this advantage that it rolls its own sheets or tack plate, to use the trade term, and is thus assured both as to even quality and regular supply of the raw material. The tack plate which is rolled at the company's principal plant at Hamilton is made in certain definite sizes and in gauges ranging from 21 to 10, the size and gauge varying according to the size of tack to be made from the sheet. The sheets are delivered to the Canada works in bundles and are stored there until required.

Pickling and Baking

The sheets at this stage carry a certain amount of scale which must be removed. This is done in the pickling process. The sheets are laid in racks, end up, and dipped in tubs containing vitriol, a fairly strong solution of sulphuric acid, which removes the scale and makes the sheets bright and clean. The rack, with its load of sheets is then lifted out and placed in another tank containing lime, which removes the acid adhering to the sheets. The sheets then undergo a baking process which restores the material to its normal condition and neutralizes the effect which the acid has had on the physical properties of the steel. The baking is done in coke-fired ovens heated to a high temperature. After baking the sheets are ready to be converted into tacks in another department.



Test taken with Recording Ammeter.

FIG. 4.

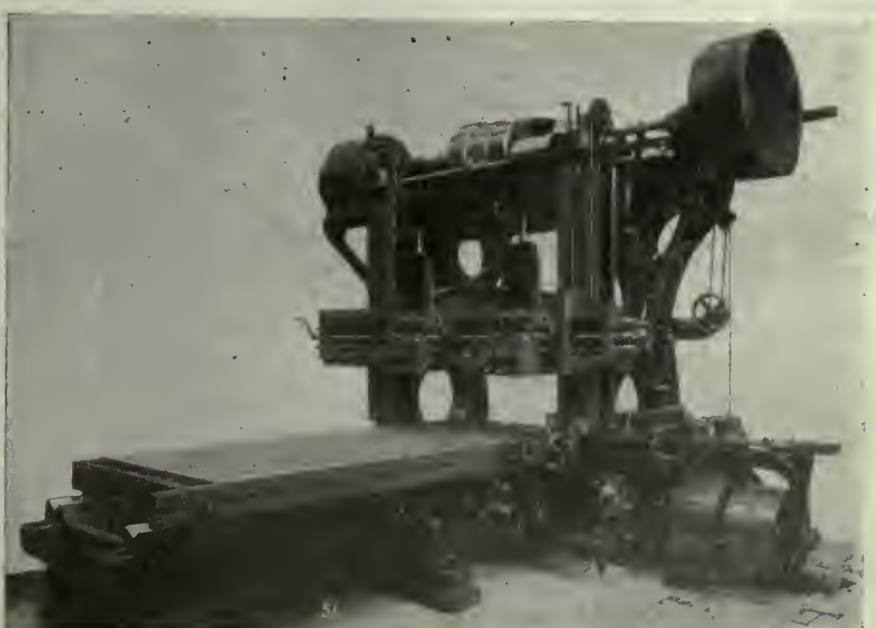


FIG. 3—A 4-FT. ENGLISH SQUARE PLANING MACHINE WITH 4-SPEED COUNTERSHAFT AND SELF-CONTAINED ELECTRIC DRIVE.

Making the Tacks

The tack machines are arranged in long rows, the material being fed to the machines in the form of strips by boys who can take care of three or four machines each. At one end of this room is a power shear for shearing the sheets into strips of varying widths according to length of tacks into which they will be converted. For the same reason the gauges vary. The tacks are made from

⅛ in. to 1⅝ in. long, inclusive. The tack machine, which is rather a complicated piece of mechanism, operates at a high speed, accompanied by considerable noise as the process is more akin to stamping than anything else. The most important feature is the timing and adjustment of the tools in the machine. There are ten tools in each machine, and each tool must get to a given point and away again to allow the next tool to do its part of the work. Needless to say this requires very careful adjustment, particularly on account of the high speed and nearness of the tools to each other. The strips are placed on the machine by the operator and then are automatically fed with tools, the tacks falling into a pan underneath the machine.

Varieties of Tacks

Tacks are made in various finishes, bright, blued, galvanized, tinned, copper, brass or nickel-plated, coated and Japanned. Blued tacks are obtained by heating them in a blueing machine or heater. The bright tacks are first annealed and then passed through tumblers which gives them the bright finish desirable for certain purposes. The galvanized, tinned and plated tacks are treated by being dipped in the ordinary way.

Picking Process

The next operation is an important one, particularly as far as the consumer is concerned for the public demands perfect tacks. During the process of converting the steel strip into tacks there is a certain amount of unavoidable wastage, because the two ends of the strip being square will not make tacks. These ends come through with the good tacks and have to be eliminated in the picking process.

The picker is an inclined revolving screen, a different screen being used for each size of tacks. The defective work falls through the holes in the screen and the good tacks pass down inside and fall into a box at the bottom. The good tacks are then taken to the packing room and put up in bulk, 25 lb. and 50 lb. boxes, cartons, etc., according to the requirements of the customer. Before being packed the tacks are all weighed so that each box, carton or package contains the correct amount of tacks. The boxes, etc., are then stored until shipped.

The tacks are made in a large number of varieties and sizes for various trades. In many cases the form of the tack varies, but the process is the same. The form and size of the tools employed in the tack machines vary in proportion to the variety and sizes of tacks manufactured. For this reason a considerable amount of work is involved in making the tools for the machines and in keeping them in good working order. The tools must of necessity be correct in form otherwise unsatisfactory work would be the result.

Orangeville, Ont.—Dods Knitting Co. will erect a $40,000 extension to their plant.

MINING DISCOVERY MADE IN CANADA

The Forest Products Laboratories of the Forestry Branch of the Department of the Interior have found a substitute for pine oil, now in such demand for the reduction of ores by the oil-flotation process.

What the oil-flotation process means to the mining world is shown by the statement of a leading mining journal that a certain great mine, which formerly recovered 70 per cent. of the metal from its ores, was now, by this process, recovering 90 per cent.

To work this process there has been required up to the present pine oil extracted from the "hard" pine trees of the Southern States. The erection of oil-flotation plants all over the United States so increased the demand for pine oil that the price went rapidly bounding upward, and it seemed as if in a short time the supply coming across the line to Canadian plants would be entirely shut off.

Work Done by Canadians

Cobalt is one of the districts most concerned, and some of the aggressive operators there started experimenting in the way of trying to make for themselves a pine oil from Canadian stumps. While these experiments were not barren of results by any means, the miners quickly realized that this was the work, not of miners in small experimental plants, but of specialists in well-equipped laboratories. They therefore applied to the Minister of the Interior, who, having established about a year before the Forest Products Laboratories of the Forestry Branch for just such investigations, started the laboratories to work on the problem.

The work was done by Canadians. It achieved its twofold object. The chemists found that they could make pine oil from red pine stumps, such as may be seen any day on a trip on any of the railway lines running through the "pine plains" on which Camp Borden is situated. Had this been the only discovery it would mean that Canada would have had in this time of war to establish a new industry involving the collection of pine tree stumps over a large area and assembling them at one place for distillation. It is possible, but not likely, that such an industry may be established, as the amount of turpentine in the stumps of northern pine is limited, and pine oil is secured from turpentine by a second distillation.

Substitute Found

But the second object of the search was of still greater importance. It was discovered that one of the creosote oils, thrown off as a by-product of the hardwood distillation industry, would serve in the oil-flotation process equally well with pine oil. This by-product up to that time had so little market value that a good deal of it was burned for fuel. It is produced now at the rate of nearly twelve hundred gallons per day in Canada.

It seemed at first almost too good to be true that a comparatively waste product would take the place of the costly pine oil, but the new oil was thoroughly tested in the ore-dressing station of the mines branch, Ottawa, before public announcement was made. The result of this division of labor between the government and the miners is that the government chemists solved the scientific problem and the miners are now working out the practical application in their plants, with increase in economy and efficiency. The miners get a much cheaper material, and the wood distillation plants have now a market for another of the by-products of their industry. Both industries are naturally pleased with the result. It means also that money formerly sent abroad is kept at home to build Canadian industries.

WOULD REGAIN ONTARIO TRADE

British Columbia will reopen its Toronto lumber office. Some months ago L. B. Beale was recalled to Victoria and the office was closed because of war financial conditions. B. C. lumber interests have been conducting a very serious lobby to have this reopened, on the ground that all the good work done by the office has proved of great value to the B.C. lumber industry. The business connections created by the office went by the board when it was closed.

Just at present there is strong competition for Ontario business, of which the American lumbermen are getting the biggest share. The need for the resumption of an educational campaign to crease the use of B. C. lumbsr in Ontario has been forced upon the government of the far Western province, and an agitation was commenced recently to push the claims of the B.C. product in the Ontario field. It was felt that the demand in this province for Douglas fir and other timber from the coast was down to an irreducible minimum, and with the slump in wooden shipbuilding throughout all Canada this has caused a decision to expand the present markets.

Mr. Beale, who was formerly in charge of the Toronto office, has been appointed special lumber commissioner for British Columbia to Europe. He will seek to extend the market for British Columbia products in Great Britain, France and other countries. He will come East in the very near future, and will make a survey of conditions in Eastern Canada before departing for Europe.

Architects in Ontario have been extensive users of Georgia pine and other American woods for building purposes, and it was largely through Mr. Beale's work in the East that the British Columbia lumber began to win greater popularity. The Toronto office was closed at a time when B.C. lumbermen were too busy filling orders for outside territory to make use of the Ontario field to the best advantage.

The decision to institute another campaign is an important one to the building trades in Ontario, indicating that another Canadian industry is seeking to reestablish itself on a permanent basis after the unusual conditions occasioned by the war have to a large extent been altered.

FROM THE MEN WHO PRODUCE

Methods, Machining Devices, Systems, and Suggestions From Shop And Drafting Room

METHOD AND TOOLS FOR MACHINING A SPLIT RING

By F. Scriber.

An interesting example of machining by the use of special tools is described and illustrated in this article. The part to be operated upon is the split ring shown in Fig. 1. This ring is machined from a bronze casting, the operation of splitting apart being the last that is performed upon it, with the exception of burring.

In handling this piece it is first gripped in a three-jawed chuck, the hole is bored and faced, it is next gripped by the inside diameter and the opposite side is faced, these portions being indicated by finished marks. The outside is unfinished with the exception of filing and that part of the work which is of particular interest consists of drilling the holes, spot facing and cutting apart. For the drilling and reaming operations we proceed to drill by using a jig such as is shown in Fig. 2. The holes to be drilled and reamed are four in number, A, B, C, and D, Fig. 2. The ring is placed in the jig in the manner shown locating from the hole on the stud E. When the work is placed on this stud the slip collar F is slid in place and the work is securely clamped into position by means of a hand knob G. For radial location around the centre of the large hole the boss X is forced against the head of the bushing H by means of the thumb screw J, these arrangements locate the part so that all work produced in this jig will be interchangeable, suitable bushings as is obvious being used for guiding the drills.

The next operation on this part is shown in Fig. 3. This consists of spot facing the bosses where indicated and a very simple tool is provided in this connection. This tool consists of an angle iron A in which are placed two pins B and C; one of these pins C is flatted off on the side so as to permit of slight variations in the centre distance of the work. The part is slipped on to these two pins in the manner shown and the surface X is spot faced. To spot face the surface Z it is only necessary to slip the work off the pins, turn it over half a revolution and slip it back on again. It is not necessary with this tool to provide any means for clamping the work. The angle iron is of course clamped down to the drill press and by using a regular counterbore with a teat on it this operation is readily performed.

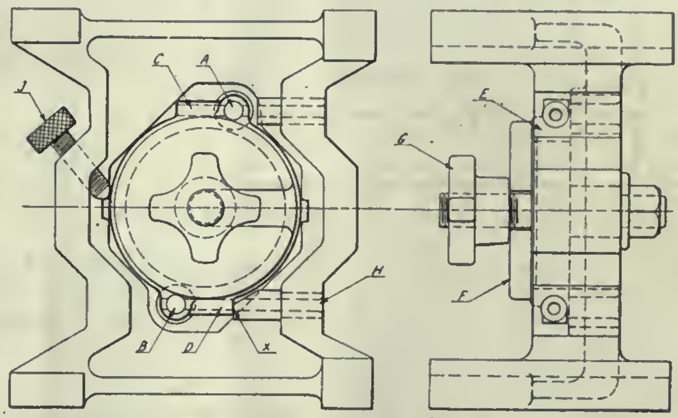
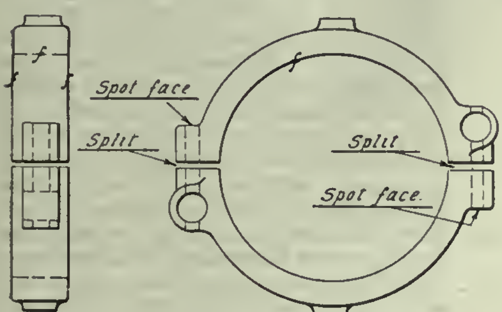


FIG. 2—JIG IN WHICH RING IS DRILLED.

Having now completed the machining on the ring it is split in half on the milling machine, using the fixture shown in Fig. 4. The ring is again located on two pins A and B, at this time it is clamped to the fixture by means of the two clamps C, the clamps being constructed in the usual manner with nuts and washers D used for clamping purposes. The spring E is for holding the clamp up while the work is being removed. A headless screw G with a check nut J on it is used under the heel of the clamp while the base of the fixture H is made of cast iron. This fixture has two tongues F which fit in the slots of the milling machine table, and a slot K is cut across the top of the fixture as clearance for the saw which splits the ring.

These fixtures, while not expensive, are very efficient in operation and are a very good investment for handling such work in moderate quantities.



RING THAT IS TO BE MACHINED AND SPLIT.

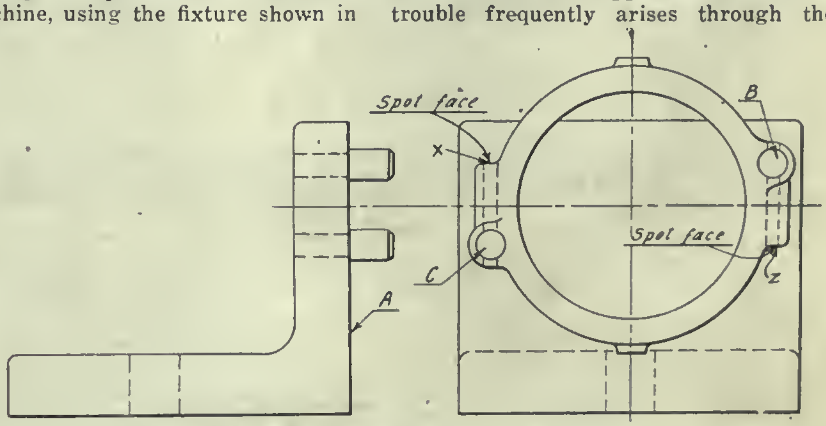


FIG. 3—FIXTURE FOR SPOT FACING.

COPPER BAND CRIMPING DEVICES

Rejected shells have often resulted from defective copper bands. This trouble frequently arises through the copper band being unevenly located when it is placed on the shell, the effect being to force the metal into the groove in an irregular manner, so that when the ring is subsequently turned it is found to be defective. A very useful tool that has been designed to overcome this ob-

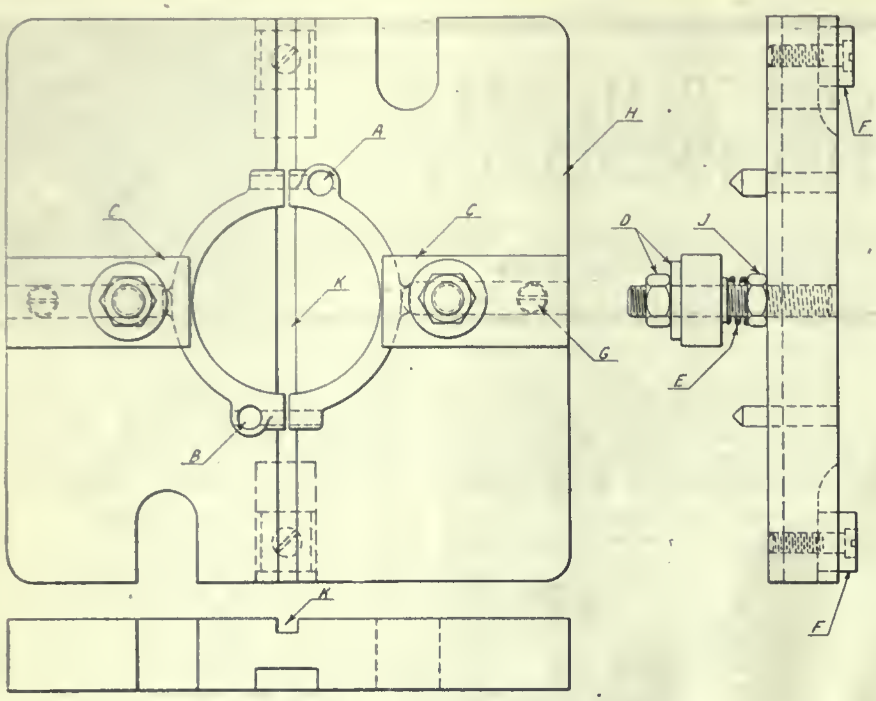
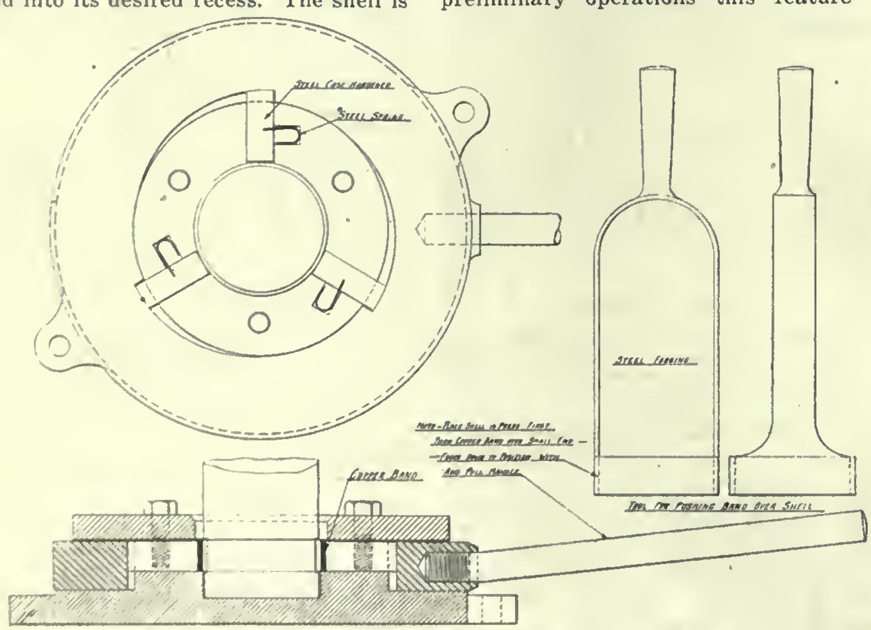


FIG. 4—FIXTURE FOR SPLITTING RING APART.

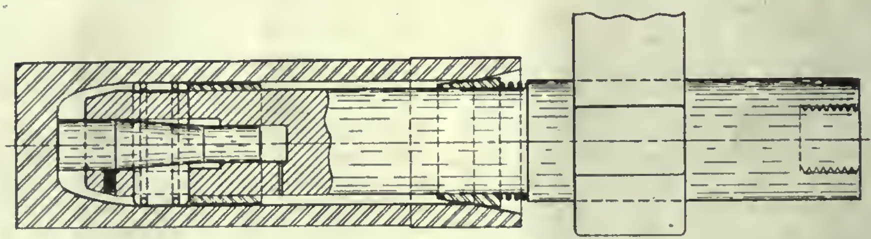
jection is shown in the accompanying line sketch. The purpose is to crimp the band correctly in position before the operation of banding in the hydraulic press. Where a large number of shells are handled the device has proved a great labor saver and also been the means of eliminating much of the trouble formerly experienced through defective bands. To operate the shell is first placed in the centre of the fixture and then the copper band is placed over the nose end, and tapped to the desired position by means of the steel forging that is designed to pass over the shell. The device is so constructed that the copper band can only be forced to a location in correct alignment with the groove. When in this position the handle is pulled around and the cam plate forces the cams inward, pinching the copper band into its desired recess. The shell is then removed and is ready for the hydraulic press operation. The entire operation occupies about 10 seconds.



DEVICE USED IN CRIMPING COPPER BAND ON SHELLS.

RECENTERING ARBOR

In the efficiency of shell production an essential factor is that of the concentricity of the walls after the machining has been completed. During the preliminary operations this feature is not so important as the operations that follow the finishing of the interior. It is necessary that the centre in the base upon which the final turning is performed, be placed in exact alignment with the finished bore of the shell, and in order to do this it is imperative that the tools upon which this operation is accomplished, be rigid and highly accurate. The arbor here illustrated has given very good satisfaction and the work performed has been of the highest quality. The shank of the mandrel is made to fit the spindle of a small lathe, the outer portion of the shank being supported in the steady rest shown. The open end of the shell is centrally located at the inner end of the arbor by the cone shaped ring which is forced outward by the action of the compression spring. This allows for any slight variation in the length of the shells. The cast steel plunger fitted into the nose of the arbor acts upon the three cast steel tempered jaws, forcing them out to the inner wall of the shell and bringing the same concentric with the axis of the arbor and also prevent undue wear upon the gripping jaws. Very little pressure is required to operate the jaws, and the pressure of the drill when working is sufficient to maintain the shell in position.



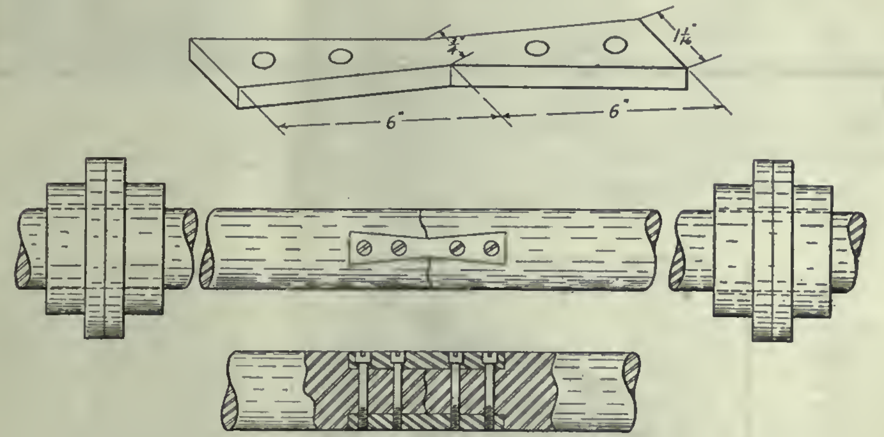
Two Hamilton boys, Duncan M. Stewart and Charles C. Dickson, have been appointed to prominent positions on the executive of the French-American Constructive Company, of New York, a concern, it is said, with unlimited financial backing, that has recently come into being for the purpose of facilitating commerce and industrial rehabilitation in the Allied countries as soon as the war is concluded. This company has been organized ostensibly to promote trade between Canada and the United States and the Allied countries, to act as distributors for Allied concerns wishing to have trade intercourse with either Canada or the United States, and to purchase direct from Canadian or American concerns for buyers in the European Allied countries. The Duponts—a name that stands for some substance in the realm of finance—are large shareholders of the new company. Duncan M. Stewart, manager of the company, is a brother to Charles Stewart, of the Hamilton civic waterworks department. Charles C. Dickson, vice-president of the company, who received his early business training in the offices of the old Great Northwestern Railway in Hamilton, is a son of M. C. Dickson, of the Consumers' Lumber Company, Limited.

REPAIRING A LINE SHAFT

By J. H. Houldsworth.

A main line shaft broke between two couplings as shown in sketch, and was repaired in the following manner:

The shaft was 6 inches diameter, and the repair had to be executed as quickly as possible. The first thing done was



to take a bar of steel and make two keys ¾ inch wide at the centre and 1 1/16 inch at the ends by ⅞ inch thick and 12 inches in full length. The keyway was drilled out with the shaft in place with a portable electric drill, then chipped out with an air gun and the keys made a good fit, two being placed diametrically opposite each other.

Four ½-inch holes were drilled and tapped in the shaft and fillister head screws were made with a long head to allow them to be screwed home tight.

Although a new piece of shaft was secured, we had no occasion to use it, as since the repair was made the whole thing was welded with a portable outfit which made a very satisfactory job and at a much less cost.

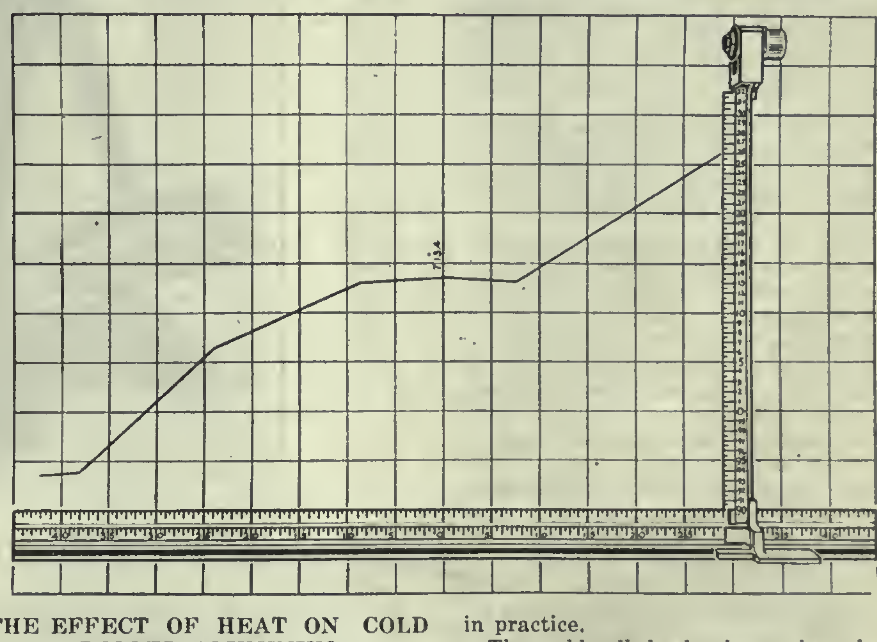
NOVEL CROSS SECTION PLOTTING SCALE

By Frank C. Perkins.

THE accompanying drawing shows the construction of a new cross-section plotting scale recently designed by Edw. A. Zorsch of Rochester, N.Y. The instrument consists of a horizontal piece and an arm. The horizontal part has a beveled straight edge, a scale, and a groove running longitudinally. The arm has a beveled straight edge with unnumbered graduation thereon, a looped flexible taper suitably graduated and made to move adjacent to the straight edge, and a spindle at the outer end by means of which the flexible tape can be moved back and forth. The inner end of the arm has a piece which fits in the groove of the horizontal member, and an index which cooperates with the horizontal scale.

It is pointed out that when using the instrument for plotting sections the horizontal member is placed with its straight edge on a horizontal line of the cross-section paper. The line is then given an elevation, after which the looped tape scale on the arm is moved until that number on the tape which corresponds with the elevation of said line is brought into coincidence with the line. The instrument is then ready to use.

It will be seen that distances to the right or left are read from the horizontal scale, while elevations are read directly on the arm. The use of this instrument lessens the error that is often made of counting the wrong number of squares, as distances and elevations are read directly on the scales. The instrument is adapted particularly for very rough, undulating sections. When plotting flat sections no vertical scale is necessary. With the use of this instrument sections can be plotted on plain, unruled paper.



THE EFFECT OF HEAT ON COLD ROLLED ALUMINUM

IN a paper read before the Institute of Metals by H. C. H. Carpenter and L. Tavener some interesting facts were brought forth relating to the behaviour of aluminum sheets when heated.

The effect of heating cold-rolled aluminum sheet at temperatures from 550 deg. to 300 deg. Cent. inclusive is to cause a very rapid softening of the metal as measured by the tenacity and the percentage elongation. As regards tenacity, the same ultimate value is reached in all cases. Softening is complete in 96 hours, and from 550 deg. to 350 deg. inclusive nearly the whole of this occurs in the first hour of the test. The elongation figures show a tendency to rise slightly as the temperature falls from 550 deg. to 350 deg.

At 250 deg. Cent. the rate of softening, while still considerable, is much less rapid. Between 600 and 800 hours are required for complete softening, and here also the same ultimate value of tenacity is reached as at higher temperatures.

From 200 deg. to 100 deg. Cent. inclusive the rate of softening is slow, and as the temperature of 100 deg. is approached, very slow. The actual sequence of changes can be classified conveniently under three heads:

(1) A comparatively rapid drop in tenacity in the first hour.

(2) A tendency either to cease falling or actually to rise, such rise, in one case only, bringing the tenacity up to the original value. This period is in most cases completed in 100 hours.

(3) A relatively very slow fall of tenacity sets in and is maintained on the whole steadily.

These tests are still in progress. Assuming the present rate of loss of work-hardness to be maintained, assuming also that the metal ultimately reaches the same tenacity as specimens tested at the higher temperatures, periods of the order of from one to three years will be required for completion.

It follows that no object is gained by using aluminum of this particular degree of work-hardness at temperatures which are likely to exceed 200 deg. Cent. in practice.

The cold-rolled aluminum has been shown to lose a considerable proportion of its work-hardness as a result of being heated in the temperature range, 200 deg. to 100 deg., with hardly any recovery of plasticity, as judged by the elongation test.

Le Chatelier's view that annealing a hard-worked metal was an easy thing to do was not borne out by the tests given in the paper, as far as aluminum was concerned. On the contrary, there was much evidence that Howe's view that many changes were going on concurrently was the fact with aluminum as with the other metals which Howe examined.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

FILING MACHINE

The filing machine illustrated has been designed by the Barry Manufacturing Co., Chicago, Ill., to fill a want in the tool room of a machine that may be used for filing, lapping, metal jig-sawing, etc. It is especially useful in making dies, punches, jigs, patterns, and gauges, and also provides a marked saving in finishing small parts. The features of the machine provide for much more rapid, accurate and smoother work than is possible by hand filing and insures a saving of at least 200 per cent. The patented file holder on this machine admits of using any file, regular or special, without other equipment; jig or hack saws can also be used for sawing out dies and templets. The machine throughout is constructed with reference to durability and convenience in operation.

The table is adjustable four ways, to give any angle or clearance required on any work. Indicator scales and needles attached to table permit of accurate adjustment.

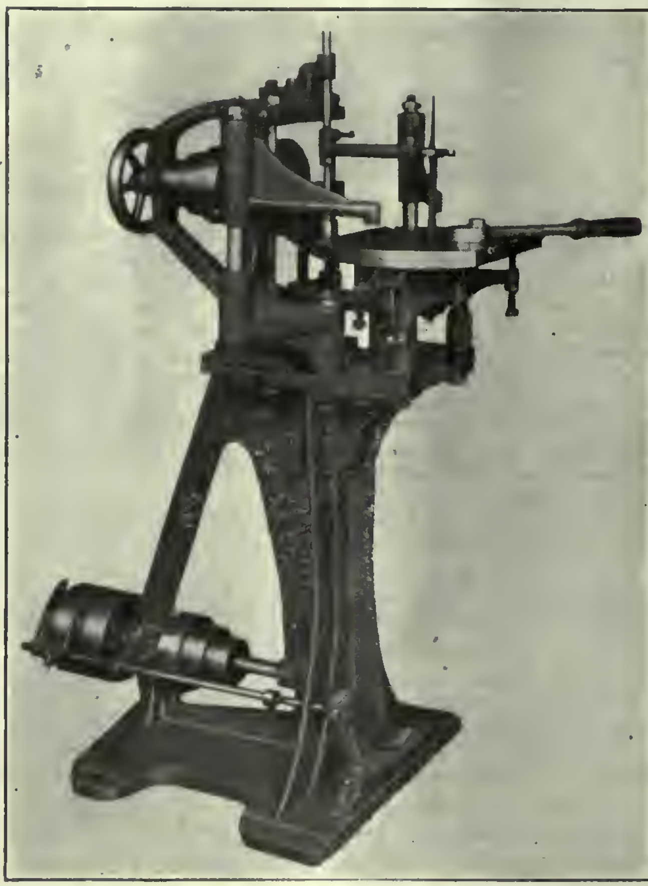
Roughing attachment provides a cam feed for fast roughing of dies and other work, and when not in use can be instantly removed.

Adjustable fingers on either side of table hold work firmly without marring and allow it to be moved freely in any direction on the table.

The ways are mounted above and to the back of work table; filings, emery powder or other abraders falling from work cannot deposit on the drive shaft or other working parts. Crossheads are slidably mounted on guide rods and carry file supporting arms adapted to operate below and above table; the distance between arms is readily adjustable to accommodate different lengths of file or similar instruments, the lower arms may be adjusted to operate close to table for different lengths of stroke.

The file holder will hold ordinary or round shank files, readily adjusting itself to taper of shank of file or similar tool. When the file is worn in one spot it may be shifted until the whole file is worn on all sides.

The countershaft is attached to base of machine and has a three-step cone, carrying a 1½-inch belt, which gives speeds of 200, 350 or 600 strokes per minute; the drive being controlled by foot treadle. Driving belt on counter shaft is 2 inches.



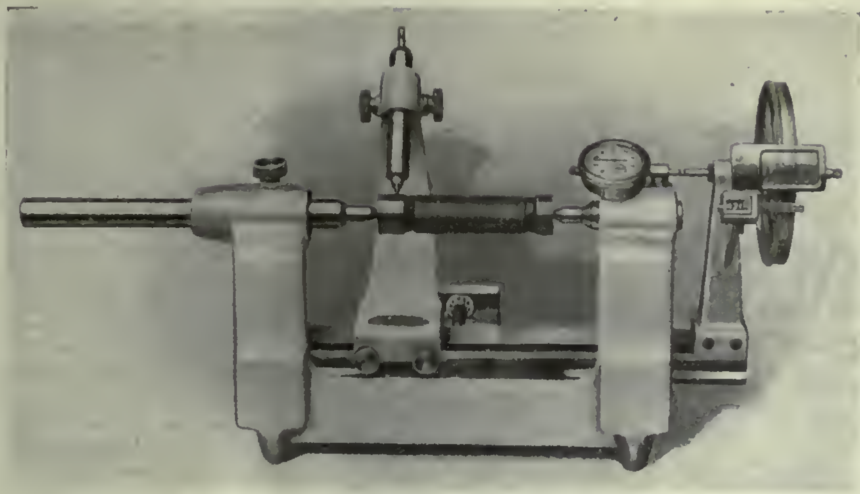
UNIVERSAL FILING MACHINE.

Motor drive can be used if desired. One-half h. p. motor of any type with speed between 1,200 and 1,800 r.p.m. can be used.

HEAD TESTING MACHINE

The "Lea" lead testing machine, sold by C. H. Tracy Co., Boston, has a three-point bearing—two stationary and one adjustable—making it easy and quick to level. The thread contact point and the micrometer head are carried on a ball-bearing carriage, or slide, so delicately adjusted that the operator can blow it back and forth with his breath when the contact point is not engaged. The thread-contact point is held to its work by means of a spring, and it may be moved from one thread to another by pulling it back by means of the small knurled handle shown. The thread gage to be tested is carried between centers. To test the lead the contact point is placed in position in one of the threads and then the micrometer spindle is adjusted so that the pointer on the dial indicator points to zero. The thread-contact point is then moved along one, two or more threads, as the case may be, and the micrometer readings taken and compared to the theoretical amount. Drunken threads are easily detected by turning the gage part way around and again measuring.

In doing the measuring the micrometer



TESTING MACHINE FOR INSPECTING THE PITCH OF SCREW GAUGES.

spindle is adjusted so as to bring the dial indicator pointer again to zero. From this it will be seen that the dial indicator is not used to actually measure with but only to show the correct amount of pressure to apply to the micrometer spindle. It will be noticed that the micrometer sleeve carries a graduated gearwheel while meshed with a pinion attached to a special counter. By the use of the large graduate wheel, readings are obtained to 0.0001 in. As the wheel turns it operates the counter, so that the operator can read his measurements directly and instantly, which greatly adds to the speed with which a gage may be inspected. In using the micrometer no damage is done in case the spindle overruns considerably. When it is not advisable to depend on micrometer readings, Johansson blocks may be used between the dial spindle and the micrometer spindle. A plug is also provided so that the dial indicator may be removed and a solid plug used in place of the indicator spindle. Johansson blocks can then be used between the contact points as before. The machine will test thread gages up to 6 in. in diameter and 6 in. long. It weighs approximately 60 lbs.

PORTABLE RADIAL GRINDING MACHINE

The Mummert Dixon Co., Hanover, Pa., have bought out a portable radial grinding machine. The machine is primarily intended for general light grinding and buffing work, and the wheel can be raised as high as a man can reach or brought down to the floor, in addition to being turned into any position between a plane at right angles to the floor and one parallel with it, as well as having a slight longitudinal movement.

The machine is a self-contained unit and is readily portable. The grinding wheel, which is 8 in. in diameter, with a 1 in. face, is driven by a motor mounted at the rear end of the tubular arm. This motor, which receives its supply of current from an adjacent lighting socket, is coupled to a shaft running through the tubular arm to a set of hardened steel spiral gears in the head. These gears are enclosed in an oil tight gear and increase the speed from 1,800 to 2,800 r.p.m. The head, arm and motor are carried on a two-wheel ball-bearing trolley, which rolls back and forth on a steel track for a distance of 30 inches. A rack and pinion on each side of the carrying frame is relied upon to keep the trolley in alignment. The motor tends to balance the head, and as it is mounted below the center of the trolley shaft, keeps the whole weight in equilibrium when the workman releases his hold. The bolster of the frame carrying the trolley is mounted on the upper end of a trunion which turns in the base. In this way the arm and the grinding head can be turned entirely around the base, thus giving a full radial grinding machine. It is also possible to twist or turn the head completely around so that the top, either side or bottom of a casting can be ground.

When the machine is being moved the trolley can be locked in the middle of the frame, and by inserting a lock pin the bolster can be locked to the base so that it will not turn radially. This arrangement, it is pointed out, will be found advantageous when the machine is being moved over the floor, since the arm can be used as a guide, similar to a waggon tongue.

In addition to the machine illustrated two larger sizes are built. One of these is designed to mount a wheel 14 in. in diameter with 2 in. face, while the other will mount wheels 3 in. wide and either 18 or 20 in. in diameter.

PORTABLE RADIAL GRINDER

BROKEN GAUGE GLASSES

By M. M.

The following hints concerning broken gauge glasses cannot be too forcibly impressed upon engineers. It is not only a matter of knowing how, but also being able to practically apply the knowledge effectively and expeditiously. The cocks on the boiler should be immediately shut and the glass replaced without delay. The new glass should be free from flaws or scratches, with ends ground square or fire-finished and of the correct length. If too long it would restrict the passage of steam to the glass; if too short, the packing may work over the edges of the glass. In many makes of gauges the correct length of the glass is stamped on the framing.

Before replacing it, the whole of the old packing should be removed, and the screws of the adjusting glands made easily workable. The packing should be placed on the glass, and while screwing up the bottom gland the glass should be kept in contact with the metal of the lower cock. Care should be taken not to screw up the upper gland hard before the lower one, as this may lift the glass, and perhaps allow the lower packing to choke the orifice.

The glands should at first be screwed up hand-tight, after which the steam and drain cocks should be opened a small amount to heat the glass gradually, when after a short interval the water cock should be gradually opened, and then the drain cock closed, the steam and water cocks being then fully opened gradually, and the glands adjusted as required. The glass should now be tested by closing the steam cock and opening the drain, when water should rush out freely. The water cock should then be closed and the steam cock opened, when steam should rush out freely. When the drain is closed and the water cock open, careful note should be made of how the water rises in the glass. It should, if the fitting is properly made, rise smartly to the water level of the other glass.

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Courtesy Does Not Cost Very Much

IT doesn't cost a very great deal to be courteous. It's the cheapest thing in which a man can invest and yet it pays handsome dividends. An experience that was related to us this week is well worth passing on.

A representative of a big house with branches in nearly all the worth-while cities of the world, had occasion to make two calls in the same city—and that same city was Toronto.

The traveller was a high-priced man, an expert in his line, and he considered it was in the interests of both the firms in question that he should call on them. He was too well versed in his business to take up more time than was absolutely necessary. Here is his experience:

"The first place I called was a firm employing some three hundred people. I asked to see the general manager. My card was taken, and after waiting some time the messenger boy went in again, and came back with the information that the manager was busy. I knew there was no one in his office for I could see in his window before coming into the building in the first place. After another short wait he came out of his office, and I was forced to grab him, book-agent style, to tell him I was around the premises. I could get no hearing at all. He would not even pass me on to his superintendent or purchasing agent. I left and I will never go into that building again, neither will I be particular to look after that man's business if he sends it to me.

"The next call I made was at the other end of the city. There was a little room where callers waited until the manager was able to see them. I seated myself there and within a very short time I had a chance to see the man I wanted. I did not even have to brush past a secretary or ring a bell. That manager came out and shook hands with me and asked me to come in and sit down. I told him the firm I was from and what I wanted to show him. He rang for his superintendent and then said, 'Both the superintendent and I are very busy today, but we will give you 20 minutes right away.' I had not taken up five when the superintendent said he was interested enough to have me come into the factory with him and go into the matter in detail. That satisfied the manager. I closed a nice order there and dropped in to thank the manager after for his courtesy and kindness. That manager controls four times as much business as the first man, and so I take it his time must have been worth much more. He could have turned me down and I know he would have done it in such a way that I would have been satisfied with his decision."

That same thing happens every day in the week. There's nothing so very new in it at all, its newness consisting in the fact that it happens so often.

But get it into you. Get it into your staff. Get it into your men that meet the public. Paste it in their hats and stamp it on the soles of their boots. Courtesy costs nothing at all, but its presence makes and keeps wholesome business conditions, and its absence spoils and mars the whole landscape, and kills off business chances faster than any other power can build them or pull them together.

Trained Hands For Farms and Shops

THE farming community in Canada has been making very serious objections to the taking of green hands hands on the farm.

In many cases they are referred to as useless, and the statement is made that a farmer takes so long in instructing them in the work that they are really a loss in the end.

On the face of it the farmers seem to be able to put up a pretty good case.

But what has been the experience of the manufacturer, of the merchant, of the publisher and of every branch of industrial life since the beginning of the war?

All through it has been a case of do the best you can with the material at hand.

If a publisher were to take the attitude regarding a prospective employee: "You are not experienced. You are not a good journalist of proved worth, therefore I don't want you," what would be the result? There would be so many empty chairs in the office that the publication would never reach the public.

And what of the manufacturer? There has been a scarcity of available men that has been almost overwhelming in spots. Could the manufacturer give instructions to his employment office that they were to say to every applicant for work, "If you are not a skilled mechanic there is no use of you applying here for a job?" Not much. There would be very little production were that the case.

The publisher has had to take the greenhorn and train him. He has had to lose money and time on him for weeks before he was able to earn his salt, and a good many times he found out that after weeks of attempted training he had picked a lemon.

The manufacturer has had in many cases to conduct very costly experiments to find out how far he could go in employing unskilled men in his shop. There have been breaks and annoyances without end, but the manufacturer had to make the best of it, and "carry on," and like the publisher he has accepted the situation as it stood and made the best of it.

Why should the farmer not look at the thing in the same way? He cannot have trained help when it is denied to the rest of the community. There are cases where greenhorns to farm work are making good as they have done in other lines. It takes no greater skill to drive a binder than it does to run a lathe, and the wielding of a hoe is no more complicated than the writing of a heavy editorial.

The farmer can get a whole lot of service out of the greenhorn help if he will set himself seriously to it.

A NUMBER of the daily papers are howling away that Canada's assortment of Cabinet Ministers should hustle back home from London, England, and attend to affairs at Ottawa. Then again there's not a few who incline to the belief that we get along remarkably well when the whole outfit's a long way from home.

IT USED to be considered a bit smart to refer to the farmer as a hayseed, but when one stops to think that farmers lead the automobile procession, and are the leading group in paying off mortgages—well, it all tends to popularize the hayseed group.

ANDREW GLEN CAME FROM SCOTLAND IN 1912

And Has Been Manager of the John T. Hepburn Plant for Two Years—A Want Ad. Brought the Right Man

IF your father's name is trusted to one or two initials for what individuality it had—if his name was Smith, Brown or Jones, for instance—no fair body could blame you for secretly wishing you could swap names with Andrew Glen. His name is more than likeable; it is Scotch both going and coming. So is he.

Fifteen years ago, as a lad of sixteen, he started work in the plant of Lees Anderson, which is on the Clyde at Glasgow. Had young Glen been a few years older, or had no business depression followed the Boer war, Lees Anderson, makers of marine engines, might be on the high-tide of prosperity to-day. As it happened, however, they carried on until the subject of this sketch learned all their drawing office could teach in two and a half years.

ANDREW GLEN

The last pulley had hardly stopped in the Lees Anderson plant before young Glen was applying what he had learned—and learning more—in the plant of Alexander Chaplin & Company—one of the largest crane makers in Glasgow. Another two and a half years at the pay of an apprentice, and he graduated as a full-fledged mechanical draftsman.

But Andrew Glen had not been content to work and learn. He had wanted to study and learn as well. During the years of his apprenticeship, therefore—years with more nine-hour working days than many men, let alone youths, care to manhandle—he studied at nights. Three evenings a week he attended technical college. Nor did he reach it by walking across the street. It was six miles from his home.

About the time that Babcox & Wilcox of Renfrew, which is near Glasgow, discovered that a good man like Glen, either goes up or goes out, John T. Hepburn, of John T. Hepburn, Limited, Toronto, concluded that the Old World owed the New the man he needed. And he used the New World method to find him—that is to say, he advertised.

Glen answered his advertisement, interviewed Mr. Hepburn's brother-in-law and, two weeks later, took charge of the drawing office of John T. Hepburn, Limited. This was in the year 1912. If questioned to-day, Mr. Hepburn would probably say no advertisement of his ever paid better than the small help wanted that found Andrew Glen.

The young man soon demonstrated that he knew a thing or two about cranes. (John T. Hepburn, Limited, manufactured cranes exclusively up till the outbreak of hostilities). Moreover, Glen showed rather unusual ability in directing work to speedy accomplishment as well as in the perfect planning of it. Consequently, within two years following his engagement, he was made manager.

Almost simultaneously with his appointment, the urgent needs of war called for a radical change in product. The manufacture of cranes could wait; the manufacture of shells and shell-making machines could not. Glen's was a man-size job all right!

How did he handle it? The well-known Hepburn special lathe for munition makers is one favorable answer. Another is the fact that John T. Hepburn, Limited, recently acquired the plant of the Martin Pump & Machine Company, in which forty men are already employed and which will produce at least, three Hepburn special lathes daily. A third, and equally significant answer, is the fact that two hundred and fifty men are employed at the parent plant, now manufacturing six-inch shells as well as special shell lathes. A fourth—is a fourth needed? No. Just consider that Andrew Glen has yet to count his thirty-second birthday.

"It isn't the salary cushion of an executive's chair—it isn't that," he said, "that drives a man to study and work his way into it. I think it is our competitive system, the pitting of men against men. The failure is all eyes for the immediate dollar. Not so the man who wins. He keeps half an eye on the dollar and an eye and a half on his work and on the textbooks and technical magazines that help him master it."

Young machinists need not conclude that an hour or two of serious study after work will prevent their enjoying healthful recreation. Andrew Glen snatched time to play association football and to win more than one road race. ten-mile marathons included. He has his medals still.

His life mirrors ability to do the things worth doing. True, he confessed, "I've never had time to get married."

But there's time yet—he's only thirty-one.

An Appetite's A Bad Thing Now

THIS cost of living is a thing what causes me to fret—I'm worried in the day time, and at night I can't forget. Why everything folks get to eat is priced so bloomin' high, that a purse would need, by gum, to reach well nigh unto the sky.

We used to buy the sausage cheap, about ten cents a yard, a nickel for a T-bone steak, and 'bout the same for lard.

And liver, too; land sakes alive, they used to get it free—it used to cost ten cents for lunch and less'n that for tea. And look at spuds, the Irish kind, the onions and the beets, and every other thing that comes in servin' up the eats.

And if you want a dozen eggs, the big ones and the slim, it costs you over half a bone, why say, they don't begin to touch the good old buying times, now gone a long time hence, when hen fruit used to sell galore at twelve and thirteen cents.

When we was kids we used to take a quarter to the store, and have a list a foot in length of what we hustled for.

And for that coin we used to get some butter and some ham, some eggs and rice, a pound of tea, and salmon in a can. We used to stack up all these things upon the kitchen range—and dig deep in our jeans to land the coin we got in change.

We passed up ham and bacon, too, and roasts of every sort, to try and keep our carcasses from wanderin' into court. And ground up steak has got the boots, rump roasts have gone likewise—we never get a hunk of ham, nor dig in on meat pies.

It is a sad, a lonely world, there's just one thing, by heck—we sometimes buy a slab of chuck what's carved from off the neck.—ARK.

MARKET DEVELOPMENTS

Final Allotment Made by Ottawa War Board

Dealers Who Are Trying to Handle the Business Finding it Harder to Secure Actual Supplies Than the Permits Covering Them—More U.S. Contracts Going to be Given Out?

DEALERS in Canada who are trying to spread around the available supply of steel, among the many firms that present orders for same, are having troubles of their own during these months. It would appear that the procedure is this way: The authorities at Washington, through the war board there, give a certain proportion of the output of U.S. mills to Canada every month. It is then up to the War Board at Ottawa to distribute this supply. This really means that the War Board at Ottawa has got to take on itself the onus of stating which firms in Canada shall have a preference on available supply of material, and the agricultural and other interests are not going to stand aside while the distribution is taking place unless they are being favorably considered in it.

Although nothing definite has been given out yet, it would not be surprising were an announcement to appear in the near future that the American war contracts in this country were to be considerably enlarged. Rumors from some of the steel centres in the U.S. which are very reliable, state that new sizes are being considered there and also draw attention to the fact that a very much increased autput of shell steel is asked for in the next few months. Canadian firms have made an enviable reputation for themselves by the way in which they have handled U.S. business on previous occasions. No doubt they would be favorably considered in any extension to the war program of the republic.

Although reports have not indicated it, the labor situation is causing some trouble in certain localities. One place where it shows very plainly is in regard to the scrap metal situation. Reports from a large number of the big centres in the U.S. state that the labor shortage is causing some delay not only in the bringing in of material in the first place but also in the sorting after it reaches the yards. In this way it is retarded from a quick move to the foundries, where it is very much needed at the present time.

Agents in this country who are handling British high speed steel believe that an effort may be made by the firms in the Old Country to get better shipping facilities to this land. In the last few months there has been a tremendous demand for high speed steel by almost every factory handling war orders in Canada, and U.S. firms have cut into his business to a very great extent. And in order to protect their interests here, British firms are likely to make a very determined effort to get their goods into the Canadian market as quickly as possible. Shipping facilities have worked against them in this regard in the past in no uncertain way.

Prices, as a general thing, have been holding remarkably firm during the week. As a matter of fact the whole range of prices has shown very little tendency to change. Reports to-day indicate that galvanized sheets are likely to go up. The mills cannot secure the black sheets for galvanizing, and the chances are that as a result all light gauges of sheets will go up. Apart from this no price changes or indication of changes are reported during this week.

FINDING IT HARDER TO DRAW NOW FROM UNITED STATES SOURCES

Special to CANADIAN MACHINERY

MONTREAL, Que., Aug. 7, 1918.—Despite the fact that the present period is generally one affecting trade conditions, the activities at the present time are almost normal in character. Production has fallen off slightly but not sufficient to affect the general conditions. The steel situation has developed an acute turn owing to the inability to get material in from the American mills. The metal market is operating under considerable tension due to the scarcity of some of the metals. Old materials are quiet with dealers reporting a nervous undertone.

Tension in Steel Situation

The continued demand for steel, coupled with the decline in production, as a result of the warm weather, has maintained the tension that has marked this situation during the past several months. That this condition may be still further emphasized is shown by the increased difficulty in obtaining ship plates from the States. Trade in steel plates has virtually been taken out of the hands of the War Trade Board as the mills in the States are unable to meet the present abnormal trade requirements. Plates for ships under Government contract are coming through but with less regularity than formerly and shipyards are consequently working at a disadvantage. Unless plates are specifically required for essential uses no consideration whatever will be given to orders placed for material. Local supply of steel plates is rapidly being depleted an dthe situation is taking on a very acute turn. Shell steel is coming along in fairly good volume, but the output has been interferred with by the holiday season, and labor shortage. Foundries are active producing billets for the recent contracts for 9.2 inch, 155 m.m., and shrapnel shell forgings. In the semi-finished steel trade the sifting out of so-called non-essential activities has added to the difficulties of obtaining material for enterprises indirectly associated with war work. The market here, if such it may be termed, is relatively quiet and all quotations are firm, but virtually on a nominal basis.

Metals

The feature of the week appears to be the difficulty experienced by dealers in obtaining metal to meet their immediate requirements. Tin continues to be the center of interest and the developments in London have had the tendency to strengthen the market here. Copper is hard to obtain and the situation is very firm. Lead is showing a tendency to advance owing to scarcity. Spelter is weaker on quiet demand. Antimony and aluminum are both quiet, but comparatively firm.

Copper.—The difficulty in obtaining supplies of copper from the United States refineries has placed the dealers here in a very uncertain position, and the general situation is one of extreme nervousness. Local stocks are declining and the undertone is noe likely to develop into a stronger market. Agitation for further price regulation continues to keep the trade in tensive mood. Dealers here report a rising market, quotations at 31 and 32 cents being an advance of ½ cent over last week.

Tin.—The situation in this metal is again developing a very acute stage owing to the inability to acquire sufficient tin to meet the requirements of essential needs. The uncertainty of delivery from England and other sources gives the market a nervous tone, and with local stocks gradually falling off prices here have advanced to the previous high. Dealers for some few weeks past have been quoting the nominal price of $1.10 per pound, but this week have again advanced to $1.25.

Lead.—Dealers are having some trouble supplying the demands of customers owing to the apparent scarcity of the metal. The present requirements are relatively heavy and stocks here are light. The market is very firm at 10½ cents, but the tendency is upwards.

Machinery Demand Slackening

Afalling off in the general demand for machine tools marks the developments for the week. Shell machinery is not quite so active but this is to be expected, as most of the plants recently receiving renewal or new contracts have placed their equipment orders. The chief concern of both dealer and manufacturer is getting the delivery of the different tools required. Shipment of equipment coming in from the states is very indefinite and the delays are causing considerable inconvenience to the producing trade. Partly used machinery is selling well, and this equipment can be secured more easily than new tools owing to the fact that second-hand machinery is not controlled by tre same selling regulations. Trading in this respect is comparatively heavy and tools are quite plentiful.

General machine shop supplies and accessories continue very active and the market is very firm.

Nervousness in Scrap

Apart from the nervous tone created here over the report that copper scraps would shortly weaken and prices decline, the situation is comparatively unchanged. The general demand has quieted down and buying is almost exclusively for consumers immediate requirements. The marked uncertainty has developed a reluctancy on the part of consumers and trade on all metals has become restricted. Quotations are firm with an unsteady undertone.

POINTS IN WEEK'S MARKETING NOTES

Reports from the big scrap metal centres make it appear certain that a shortage of labor is causing considerable delay in sorting scraps and getting it out to the consumers.

—

In every case now dealers who are getting a supply of pig iron are tied up on government contracts so that it is impossible for them to use any material for any other purpose.

—

Steel jobbers in Canada are finding it more difficult to secure their supplies from Ottawa. It appears that a certain allotment is made at Washington, to Canadian consumers, and it is up to Ottawa to distribute that.

—

A request came in to the American market this week for the supplying of a large number of machine tools to manufacture bayonets. This is about the first time that this work has been taken up.

—

Pittsburg reports to this paper that it is a much easier matter to secure a license from the War Board there than it is to secure the material itself after getting the license. The supply of steel is far short of the distribution for which the license provides.

—

Reports are in circulation that the shell programme of the United States is to be greatly extended. Some details have been given out, but on the whole information is lacking as to the number and size of shells to be brought out in the next few weeks or months.

—

Absolutely no information at all is being given out by the authorities in regard to the building of the greatest ordnance factory in the world at Neville Island. It is stated that the first guns will be turned out from there the beginning of 1920. As a matter of fact this date will be hastened by a good many months.

HARDER TO KEEP ORDER BOOKS CLEAR

Washington Gives Lump Portion to Canada, to be Divided by Ottawa War Board

TORONTO.—The steel jobbers are finding it harder to fill the orders that are pouring in on them, and they are going to find it harder later on. There is no end of orders, and as may be supposed every firm sending in an order is quite sure that his work is of the utmost importance toward the winning of the war and should beb shoved right through Washington and Ottawa and any other centre that has to do with the granting of the license. Washington, in allocating the output of American mills, lumps the portion that shall go to the Canadian users, and tosses that over to the War Board at Ottawa, and it is then up to that body to go ahead and worry with the Canadian consumers, trying to keep the strictly war business concerns to the front. The further this system is put into effect the more trouble there is bound to be, and the harder the work that will fall to the lot of the War Board at Ottawa.

Prices have shown no great tendency to change during the week. The holiday at the week-end has eased matters up a little, although in some cases there are tendencies that prices will move along again soon. From the way matters are moving it looks as though galvanized sheets were due for a higher level. The mills are finding it harder to secure a supply of the black sheets to galvanize. In fact all the light gauges of sheets are liable to go to higher levels before many days.

There is no improvement in the boiler tube situation especially as it affects the smaller sizes. There is a fair amount of the larger sizes left, but the big demand just now is for the size around two inches.

Scrap Metal Situation

Prices that have been quoted by the dealers during the last week will continue to govern the dealing during the next week or so unless something very unusual turns up. There is always a period of price stagnation around this time of the year, and the only thing that has turned up to interfere with it recently was the trend of copper and brass upwards following the action of the U. S. government in raising the fixed price on copper.

As a matter of fact there is a good deal of scrap passing just now that the dealers are not touching in the transaction. One of the largest dealers in this district stated to-day there were many of the mills with a good supply of heavy melting scrap on hand, and he did not know where it had been secured. There is only a fair volume of business moving. Scrap is not being located easily, and in many cases those who secure it in the first place are forced to go farther afield for it than formerly, and in this way they want more for their work. The labor problem not only in the scrap yards but in the premises of some of the big scrap sources keeps a lot from the market. There is not the help available to properly sort the material, and so it is held back.

No definite word has been given out regarding the disposal of the electric line from London that is passing into the hands of the scrap merchants. There is quite a bit of interest locally in the deal and it is known that several of the dealers have made a number of trips to London to look the proposition over. It ought to be definitely known in the next few days what will be done. Foundries continue to inquire for good machine scrap to ease off on their piles of pig, especially if they are not in a line that will be guaranteed a supply by the War Boa.d at Ottawa.

THOSE WHO GET PIG IRON ARE TIED TIGHT TO THE GOVERNMENT

Reports received from the various producing points in United States on the pig iron situation are as follows:"

Philadelphia.—Small lots from the Virginia makers are being sold to some of the foundry iron buyers here. Only two cars per customer are now being distributed and sales are being made only after receiving declarations of purpose from the consumers. Delivery will be made after all priority and allocated orders have been shipped.

Boston.—Some Virginia iron has been arriving here in the last few days but none of it has ever come into the open market as it has all been directed to consumers' destinations. These customers are on the preferential list and were tied up forty different ways by the Government and only one or two cars for each customer were received. Good progress is being made on onld contracts.

Pittsburgh.—Inquiries for both steel making and foundry iron continue to come forward here in very large volumes but the producers generally continue to withhold making any promises. Rather a new feature here is that many of the producers consider that it would be good policy on their part to make contracts on three months' terms, claiming that that is the period for which the Government regulates the prices.

New York.—Some of the Alabama furnaces have been taking considerable orders here for future deliveries and some of the foundrymen may have thought they were in for fairly good supplies. Later orders, however, have it that instructions from the producers to the agents were to cut down on these orders so they were reduced very materially. All of the iron thus sold was without any guarantee of any kind and delivery is to be made only after all the Government orders are filled.

Buffalo.—There is an inclination here among the furnace men to leave the distributing of their future products to the authorities at Washington as they apparently reckon that the Government people will get it sooner or later. In one case a furnace man here took on 1919 business during the last week but that was from an old customer whose plant is working 100 per cent. on Government orders, and he desired simply to be covered as a matter of preference.

Cleveland.—The demand here for pig iron continues to be very, very heavy and most of the consumers are able to show without any doubt that any iron consigned to them will be used for essential purposes and on this account shipments are going forward quite freely. The call now for iron for steel purposes is simply tremendous and it is thought here that a number of the furnaces that are now turning out pig iron will be ordered in the very near future to switch over to the basing material before the month is finished.

Cincinnati.—It appears almost certain now that the stove makers here will have to curtail their product to a considerable extent as only a few of them have been able to make contracts for iron. The word has been pased along that only those that have contracts calling for the supplying of towns for army purposes will be able to get all the iron they need an dthe others will have a hard time in getting metal that is to be used in the non-essential work.

St. Louis.—The war plants in this district are practically getting all the pig iron they require at the present time. Stove makers and others who turn out specialized lines are feeling the pig iron shortage and in many cases they have been resorting to the use of an unusually heavy tonnage of scrap.

Birmingham, Ala.—The belief is expressed in some quarters here that those who have been anticipating an increase in production of pig iron are going to be disappointed. Inquiries are coming in very rapidly and it would be a very easy matter to sell the entire product for 1919.

WANT TOOLS FOR MAKING BAYONETS

Unusual Demand Made For a Large Quantity of War Machinery

Special to CANADIAN MACHINERY.

NEW YORK, Aug. 7.—Gun makers are the largest purchasers of machinery in the market at present and several large contracts, calling for the expenditure of \$5,000.000 to \$6,000,000, are still before manufacturers; at the same time, new inquiries for machine tools have fallen off in the past ten days, which is accounted for by the recent Government decree, practically establishing a barred industrial zone on the middle Atlantic seaboard and in New England.

As various factories in the middle West are converted into munition plants there is naturally an increase in the placing of many small orders for metal working machinery. Dealers and distributors of tools in Chicago have benefited largely from this business, working at very high pressure. The volume of business has been made up, however, of numerous small sales rather than of individual large lists. At Cincinnati and Cleveland there has been a falling off in large inquiries as well as in New York and in Philadelphia.

For Making Bayonets

An interesting development has been the active demand for the lighter types of milling machines. This phase of the situation has been brought out by manufacturers in Milwaukee, who, within the last week have received telegraphic inquiry from an Eastern manufacturer of bayonets for 62 light milling machines. This is the largest inquiry for such light tools that has ever come before the Milwaukee trade, but as the Government is now placing large orders for munitions in the Central West, this demand is likely to increase rather than otherwise.

Still in Millions

The Midvale Steel and Ordnance inquiry for 300 to 400 machine tools and for 104 cranes to be installed in the sixteen-inch howitzer plant at Nicetown and calling for an expenditure of about \$2,000,000, are still before the trade. Negotiations also continue on about \$3,000,000 worth of cranes for the Neville Island Ordnance plant that is being built by the United States Steel Corp. Plans for these works, while not completed, have progressed sufficiently to make it certain that the American Bridge Co. will be called upon to fabricate 150,000 tons of structural steel for the various buildings to be constructed in the next eighteen months. As a result, the American Bridge Co. has been compelled to refuse several large Government orders calling for about 30,000 tons of steel for the construction of nitrate plants and other military buildings.

Marine Shapes

The pressing demand for the fabrication of steel for shhipbuilding has caused the American Bridge Co. to devote, temporarily, its Trenton, New Jersey, shop, entirely to the fabrication of marine shapes. These plans have caused the suspension of the steel barge building at Trenton for which the shops were especially equipped about three years ago. The Bridge Co. is fabricating steel at Trenton for fifty ships, 30 of which are being constructed by the Merchant Shipbuilding Corp. Bristol, Pa., and 20 by the Federal Shipbuilding Co. at Kearny, New Jersey. Incidentally, the Federal Co., which has just ordered two more cranes, expects [illegible] its second 9,600-ton boat for the Government about Aug. 10th.

The Newport News Shipbuilding &

Drydock Co. has put out a revised list of 15 cranes for its marine boiler plant at Richmond, Va. The Bethlehem Shipbuilding Corp. has come into the market for six additional special cranes for its Alameda, California, works. Purchases of 34 cranes for marine boiler shops are being made by the Sun Shipbuilding Co., Chester, Pa., and by the Barber Asphalt Paving Co., the latter for its Iroquois works at Buffalo.

MUCH EASIER TO SECURE LICENSE THAN THE GOODS TO FILL THE ORDER

Special to CANADIAN MACHINERY.

PITTSBURG, Pa., Aug. 7.—There was a time when it was difficult to secure export licenses. The much stricter measure of steel control by the War Industries Board has made it easier to secure the licenses, but of course it is more difficult to secure steel. In other words, steel shipments are so difficult to secure that once the War Industries Board permits any steel to be shipped the War Trade Board does not see that it has occasion, as a rule, to demur at granting the export license. In the case of Canada, requests for licenses are made to the Canadian authorities, who in turn apply to the War Trade Board at Washington.

New regulations issued from time to time relating to the distribution of steel cause more or less confusion for a while, but they soon come to be well understood and the mills find it easy to follow the regulations, so far as the regulations are concerned. Their difficulty is in the fact that the supply of steel is far short of the distribution for which the regulations provide. Time after time the steel industry has looked forward to a surplus of steel, or at least to a condition when the quantity required would not exceed the supply, and repeatedly it has been disappointed. The relations between requirements and supply have been growing tenser even in the past week or two and mills have now given up any expectations that steel will become relatively plentiful.

Expanding War Program

The shell program has been greatly extended. Some details have been given out, but on the whole, information is lacking as to the number and size of shells to be handled in the next few weeks or months. What is definitely known by the steel trade is that it is called upon to furnish much more shell steel than formerly. One estimate is that in place of 425,000 tons a month lately furnished there is to be provided 500.000 tons a month for the remainder of the year. These figures are probably below the mark rather than above.

The extent to which consumption of steel in shipbuilding is expected to grow is clearly brought out by the fact that there is now accumulated something like a million tons of steel at shipyards and the fabricating plants serving them, but C. M. Schwab, Director General of Shipbuilding, wants to increase this stock, and is calling upon the plate mills to make stronger efforts. It is plain that if with rate of shipping in the past few months a million ton stock could be accumulated in so short a time, the rate of shipping was far in excess of the rate of consumption, hence if heavier shipments are desired it means that the rate of consumption is expected to increase very greatly. This can readily be understood, for the shipways now in operation should work more and more rapidly as time passes and there are many shipways still to be completed. It is a curious thing that there is no official information, in anything like complete form, of the number of steel shipways completed and to be completed. Fragmentary information on the subject makes it clear that the number in actual operation at present will be largely augmented.

Greatest in World

As is well known, the greatest ordnance factory in the world is being built on Neville Island, in the Ohio river, a few miles below Pittsburgh, through the formation of a partnership between the United States Government and the United States Steel Corporation. The partnership contract is a remarkably brief one. The Steel Corporation supplies the organization and engineering services, gratis, also the blast furnace, already existing and the steel-making department it will build, these to remain the property of the corporation. The Government supplies all the money for building the ordnance factory proper, and will own it. The main offices of the "U. S. Steel Corporation Ordnance Department" are located in the building in which this report is written. Despite the magnitude of this undertaking and the great public interest there is in it, there is absolutely no information given out for publication. When the announcement was first made in Washington it was intimated that the plant would turn out its first big guns early in 1920. The statement is rather amusing, as it merely represents the War Department profiting by its experience in connection with the aircraft program, which was set for a little bit too short a time, hence much criticism when it was not carried out. The guns will undoubtedly be in actual service before the beginning of 1920. Illustrative of the lack of information on the subject, one of the Pittsburgh daily papers prints a statement that the contract for the "grading and foundations" has been let, amounting to $5,000,000 or $6,000,000, which is quite absurd, for Neville Island requires no grading and the cost of foundations is necessarily only a small fraction of the cost of the buildings and machinery they will support. Equally out of line is a statement published in all seriousness that the American Bridge Company will be called upon to fabricate 150,000 tons of steel for the buildings during the next 18 months, while the total fabricated steel will be 200,000 or 250,000 tons. Either the time mentioned is altogether too long; or there is included a large amount of fabricating for gun carriages, etc., as the plant operates. One thing, however, is well known. The plant will specialize upon very large guns, particularly 14-inch and larger, with their ammunition, and its operation will not interfere in any way with the regular shell program as being expanded from time to time.

Steel for Jobbers

The War Industries Board's regulations dated July 2, relating to supplies of steel for jobbers during August, have been received in various moods by the steel mills. The general program, previously formulated, is for jobbers to confine their shipments to the purposes on the preference list, report the shipments by month. A special arrangement has been made for August, however. This is that the mills ship jobbers during August an amount of steel equal to the average monthly shipments in the first half of this year. The replacement steel was given Priority B-4 and it is assumed that the August shipments are to be regarded as having the same priority. Some mills point out that they could not ship in August without having scheduled the material weeks before. Others observe that they have so many higher priorities that they could ship very little material against a B-4. Others explain that they have no specifications from jobbers on which they would venture to ship, expecting the material to be what the jobbers most need. They have specifications filed last November, and the jobber, given the privilege of receiving a certain tonnage of steel, might want an entirely different description now. Other mills say they have studied the regulations and expect to experience no difficulty in carrying them out. It is partly a matter of temperament and partly a difference in the position of different mills.

Production

Production continues very satisfactory indeed, considering the conditions. In every previous year there has been a sharp curtailment in July and August, due to the heat. This year the industry has run through more than half the period and is, in substance, maintaining the excellent rate shown in June.

SHELL CASE BLEW TOY OFF FURNACE

The Unlucky Number 13 Was The Number That Contained Live Matter

The Judson Iron Works, Oakland, Cal., received a carload of scrap from Arizona last week which nearly wrecked the plant. The load included a number of 3-in. and 5-in. shell cases, and some of them proved to be still loaded. The explosion of one of these shells in a furnace blew off the top of the furnace and narrowly missed doing some very serious damage. Investigation revealed 25 such shell cases in the shipment, 13 of which were loaded.

SHORTAGE OF LABOR MAKES IT HARD TO SECURE SCRAP NOW

In connection with the scrap metal situation in many of the large points in the United States it would appear that the labor shortage is one of the biggest factors interfering with the sorting and securing of supply for the foundrymen. Reports from the various centres are as follows:—

New York.—A great many of the larger yards here have been forced to curtail operations on account of the labor shortage. Cast scrap remains in particularly heavy demand with the bulk of this material going to local foundries. Reflecting the continued sharp demand for cast scrap are the higher prices now being paid for stove plates and grate bars.

Boston.—There is a large volume of trade moving but labor is holding back a good number of the contracts and causing some serious delay in the filling of them. It is a safe estimate to say that in some weeks the yards are unable to handle any more than 50 per cent. of their work, while at the outside 60 per cent. efficiency has been about the normal figure during this sommer.

Philadelphia.—Small lot trading seems to characterize the scrap situation here, as it seems to be very, very difficult to locate any large tonnages. Borings and turnings are being eagerly sought by blast furnaces to increase their output of pig iron and reduce the coke consumption. The labor situation is also a very acute one here, although in some cases it is pointed out that the yards that are having trouble in securing men are the yards where they are not paying sufficient wages. Several reports have been circulated here to the effect that the Government intends to commandeer all the available scrap, but this report is denied almost as quickly as it is put in circulation.

Pittsburgh.—The stocks of scrap in the yards of dealers here are reported to be very low and in some cases entirely exhausted. Large orders are not coming into the yards here at all, as it is explained in many cases all the scrap is being used in the district where it originates.

Buffalo.—The opinion of many of the large scrap dealers here is that the labor problem is the biggest thing they have to go up against at the present time. Not only are the yards handicapped by the lack of men but the consumers say that they have not sufficient help to handle the scrap when it comes to them. Many of the dealers are not able to classify and sort the stock as it comes to them and because of this they are not able to pass it on quickly to the trade. In fact some tonnages of scrap have been refused in this locality lately because there is not the labor supply to deal with them.

Cleveland.—Heavy melting melting steel is in particularly heavy demand here just now but the supply is no better than before. There appears to be a very large stock in the yards of some of the dealers but is of a miscellaneous character and requires a very great deal of handling and sorting of a more or less skilful character before it can be placed on the market. Some of the dealers say that with a new 25 per cent. increase in freight rates they are losing money on contracts that were figured on a rather narrow margin.

St. Louis.—One thing that is very noticeable in the scrap supply situation here is that railroad offerings are becoming very scarce. In fact in some cases they have almost reached the point. This week there were hardly any lists at all from the transportation companies and it is not likely that any will be sent out in the near future. Since the Government took control of the railways there is a tendency as a matter of policy on their part to sell all scrap direct to the consumers, and dealers claim that in this way they are being eliminated from the transaction. Reports from American points would also seem to indicate that there is a very acute situation in the sheet steel markets. Many of the salesmanagers for the large concerns know quite well that the jobbers are in dire need of all grades of sheets. The jobbers are lo wbecause supplies to them have been curtailed very materially during the last 60 days.

Other reports claim that in the Pittsburgh district the mills are showing a further decrease in sheets. It is estimated there that the output does not exceed 55 per cent. of the capacity.

Report from Chicago claims that the extreme heat during the past fortnight has had some effect in reducing the output of the sheet mills.

Current News in Photograph

GAS MASKS

GOVERNMENT experts of all countries are constantly trying to develop means of protection against poisonous gases, against which the men have to battle daily. Masks of all types are used continually in most attacks. Our photo shows the masks now used by our Allies and the enemy. From left to right they are: American, British, French and German masks.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	125 00	125 00
Spelter	11 00	11 00
Lead	10 50	10 00
Antimony	15 50	18 00
Aluminum	50 00	58 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Effective Feb. 5, 1918.

	Black	Galvanized
Standard Buttweld	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 16	7 29
⅜ in.	5 16	7 29
½ in.	6 55	8 12
¾ in.	8 28	10 41
1 in.	12 24	15 39
1¼ in.	16 56	20 82
1½ in.	19 80	24 89
2 in.	26 64	33 49
2½ in.	42 72	53 53
3 in.	55 85	70 00
3½ in.	70 84	87 86
4 in.	83 93	104 10
Standard Lapweld		
2 in.	$ 29 60	$ 36 08
2½ in.	44 46	54 70
3 in.	58 14	71 53
3½ in.	72 68	90 62
4 in.	86 11	107 37
4½ in.	97 79	122 56
5 in.	114 00	142 82
6 in.	147 80	185 28
7 in.	192 80	241 57
8 L in.	202 50	253 75
8 in.	233 30	292 32
9 in.	279 50	350 18
10 L in.	259 20	324 80
10 in.	333 70	418 18

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES

4" and under, 45%.
4½" and larger, 40%.
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$20 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 25	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	26 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs	9 00	8 50
Cast borings	12 00	12 00
Stove plate	24 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	8 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 add	20
Machine screws, o. and fil. hd., brass add	25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws list plus	20
Collar screws list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts add 40,	10
Cold pressed nuts to 1½ in. add	$4 50
Cold pressed nuts over 1½ in. add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 00
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	8 65
Can. plates, all bright.	9 50	9 50
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 20
Premier, 10¾ oz.	.....	9 50
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	37½
Disston	50
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XX. No. 6. August 15, 1918.

New Works of Westinghouse at Philadelphia

The New South Philadelphia Plant of This Company Was Put Up in Record Time—A Little Over a Year Ago the Present Site Was a Plowed Field

SPURRED on by the need for ships, the Westinghouse Electric and Manufacturing Company has made a record in the erection and operation of its South Philadelphia works, now devoted entirely to the production of ship propulsion machinery for the navy and merchant fleet. A little over a year ago the present site was a plowed field; now it contains seven large buildings which give employment to 2,500 people. These buildings, comprising a floor space of over 600,000 square feet, include a pattern storage shop, foundry, forge shop, power house, erecting shop, and two machine shops.

The location is Essington, or South Philadelphia, about nine miles from Philadelphia on the banks of the Delaware River. Two steam railroads, an electric line and the river afford means of transportation, though the last mentioned has not as yet been utilized.

The greatly increased demands on the Westinghouse Electric and Manufacturing Company for steam-electric generating units, led to the necessity of seeking enlarged facilities, as those at East Pittsburgh were already crowded, and the South Philadelphia site, embracing 500 acres, was chosen as possessing more desirable qualifications than any other considered.

It is expected that eventually this plant will be of a size comparable with the East Pittsburgh works, which now employ in the neighborhood of 25,000 people, and cover a floor space of over 100 acres.

A portion of the land will be devoted to a town site capable of accommodating about 5,000 people, though as yet no housing has been erected in deference to the desire of the government that all building activities be restricted to those closely related to the production of materials needed in the prosecution of the war.

An interesting feature is the use of standard gauge trucks through the yards and buildings so that all transportation whether railway or interworks, is carried on the same tracks, and maintenance of tracks and equipment of different gauges is avoided.

Electric energy for operation of the works is obtained in the summer months from the Philadelphia Electric Company at 66,000 volts, and through the steam turbines in the company's plant in the winter months, when the exhaust steam is used to heat the buildings. Distribution of current is made throughout the

EXTERIOR VIEW OF FOUNDRY.

WESTINGHOUSE ERECTING SHOP.

grounds at 6,600 volts by means of lead covered cables laid underground to substations located in the various buildings. Here it is changed to the current of the proper kind or character for the work to be performed.

Compressed air for manufacturing purposes is obtained from synchronous motor-driven air compressors located in the substations.

Water for all purposes except drinking and cooking is obtained from the Delaware River through an open canal, which terminates in a reinforced concrete box on the testing floor in the erecting shop, where an adequate supply of water is required for testing purposes.

A similar and parallel canal acts as an outlet and storm sewer, the entire installation having been designed to take care of anticipated plant development.

An unusually elaborate sewage disposal plant, embodying the Imhoff system with lime as a precipitant, has been installed.

The selection of the site and the general direction of all the activities incident to the erection and operation of the plant have been in charge of Mr. H. T. Herr, vice-president, who has had as his assistant, Mr. R. B. Mildon, who has had general supervision of the construction of the plant.

The plant has been erected by Westinghouse, Church, Kerr & Company, with which firm, Mr. Calvert Townley, assistant to president, has handled all business relations, subject to the approval of the president, Mr. E. M. Herr.

WORKING WITH OR AGAINST THE OTHER SHIFT

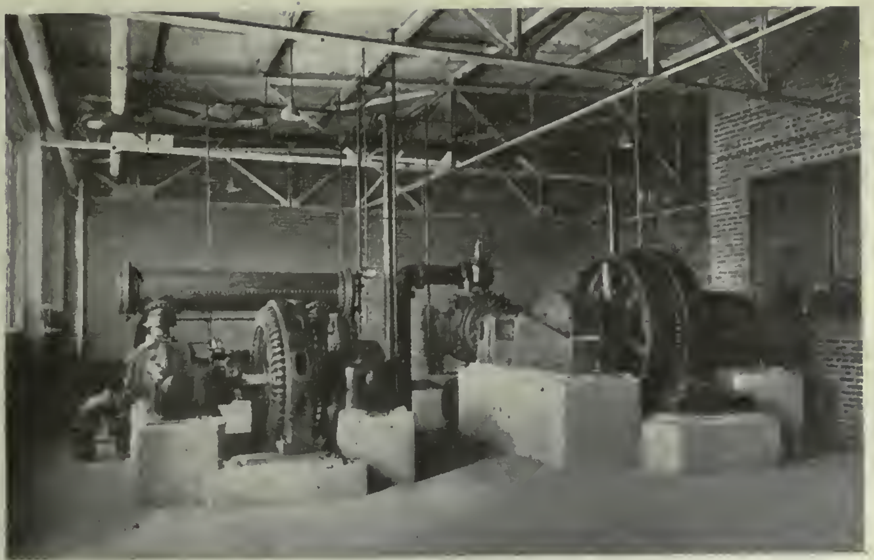
By J. H. Rodgers.

Factory harmony may frequently prove to be a very important factor in determining the resultant efficiency of any industrial plant. This not only applies to the smoothness and regularity in which the work progresses through the sequence of the many detail operations, but to the conscientious co-ordination of the different parties involved in the achievement of the results desired. Apart from what has been attained by the adoption of automatic, semi-automatic, and special purpose machines for increasing and maintaining production at maximum figures, the human element still remains the foundation upon which the structure stands or falls. From the head executive to the small errand boy, every intermediate employee is responsible for the performance of certain duties upon which depends the success or failure of the enterprise. Weakness in any structure must inevitably mean its partial or total collapse. To repair this defective for serious results are effected is not only a necessity, but it is equally essential that the cause of the trouble should be located, and steps taken if possible to prevent an occurrence of the trouble.

STORAGE BATTERY TRUCK FOR INTER-SHOP AND YARD WORK.

In many manufacturing establishments, production is often affected by the petty dislikes or grievances of some of the workmen or foremen, or the lack of co-operation between different departments, in which interharmony and mutual understanding is of vital importance, when considering plant efficiency as a whole. It may often happen that individual inefficiency can be traced to a certain workman—at least as far as outward appearances prove—but upon

INTERIOR VIEW OF MACHINE SHOP.



INTERIOR OF SUBSTATION, WESTINGHOUSE PLANT.

closer investigation it may be learned that others are indirectly involved for the unsatisfactory achievement.

The Way to Success

Nowhere is close co-operation more urgently required than in those factories where progressive operations are carried on in the manufacture of this product. This applies particularly to the shell making industry as an outstanding example of production on a highly standardized basis. In the majority of munition plants the character of the work and the quantity produced requires the installation of equipment that will virtually meet the predetermined requirements. These expectations are invariably based on the supposition that the workmen employed will continue to operate their machines with comparative regularity to avoid unnecessary disorganization in the routing of the work.

Needless Squabbling

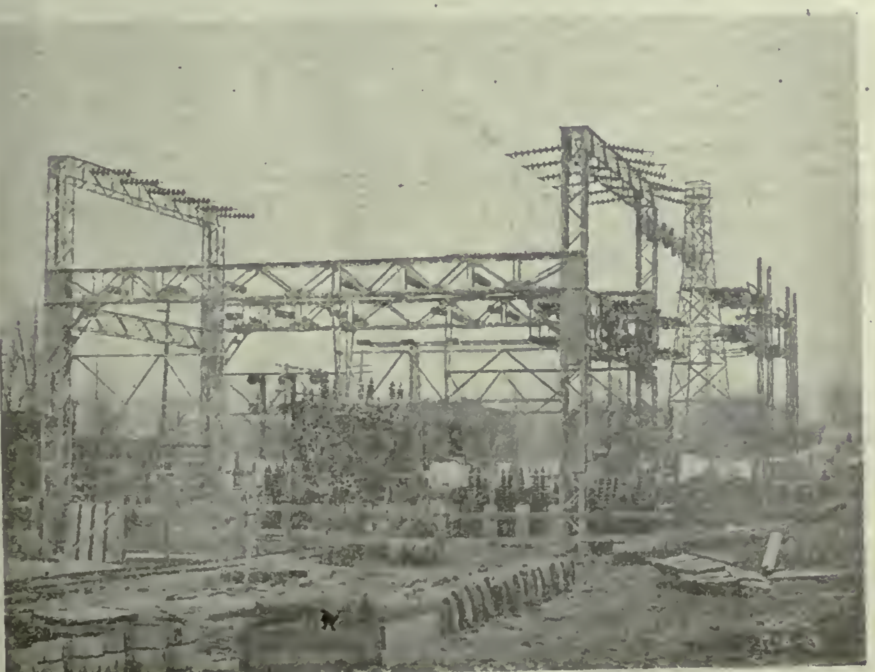
Mutual misunderstanding or petty differences may lead to conditions that cannot but reflect on the progress of the work, and consequently the ultimate output. The writer, on several occasions, has listened to—and been inwardly amused at—somewhat heated harangues between two employees on adjacent machines as to the careless manner of the former in getting rid of the shells after his own work had been accomplished. Some men are so selfishly inclined that little or no consideration is given to anyone or anything, unless they can directly benefit. In one of the instances just referred to it appeared a particular delight for the first man to place his mate—on the succeeding operation—to the extreme inconvenience in picking up the shell for his particular operation.

A Friendly Spirit

A feature that seems to have received little attention is the possibilities that might be derived by developing a more friendly spirit among the men, particularly between those men that are called upon to operate the same machine on the different shifts. In many instances these two men never see each other, and where two workmen with widely different characteristics are operating the same machine—one by day and the other at night—it is quite reasonable to expect that perfect harmony cannot exist between the two unless some kind of mutual understanding exists between them, and which can only be acquired by personal contact. I have spoken to men who have told me that it was sometimes an hour before they got going owing to the inability to locate the tools and put the same in condition to his own particular taste. Asking one of these as to the care he exercised in leaving the machine and tools in good condition for the night hand, he replied, "Why should I worry, I have to look out for myself when I come in in the morning, why shouldn't he?"

To illustrate what might be done in this direction, I might cite an instance where the peak of efficiency was attained in machine tool operation. It was in connection with shell making, and strange to say was brought to my notice by one of those who made a remark similar to that quoted above. To quote the "dissatisfied" workman—"I wish I had a night mate like this chap next me, he succeeds in getting out from 5 to 10 per cent more work than I do and appears to do so with a lot less trouble." Upon inquiring from the lad referred to I learned that the man on the night shift was his own brother and that they had made a close study of the machine and operation, with the object of making the most of their opportunity. "We always endeavor," he told me, "to have a few minutes together on the change of the shift to explain anything that will possibly assist the other in his work during his period. By doing this we can learn the condition of the shells then passing through, whether it is a series of hard or mild steel, so as to guide us in the grinding of our tools and the general operation of the machine. Not only in the actual operations do we have a mutual understanding, but in the location of all accessories such as oil cans, wrenches, gauges and all other tools, we have made a practice of having these always in their own place so that no hunting is required when one or the other of us require them. By this method we have been able to devote all the time to the actual work in hand and I believe that our record is not equalled by any other two men in the shop."

It was not that either of these young fellows were better workmen than others in the shop, but that they had started out with the idea that a minute saved was a minute earned, and in the piece-work principles of production the minutes saved invariably meant money earned. The results of these two men were not only satisfactory, but highly profitable.



OUTDOOR SUBSTATION AT NEW WESTINGHOUSE PLANT.

Man vs. Nature in Manufacture of Diamonds

Experiments Have Been Conducted Trying to Devise Process That Would Successfully Produce Precious Stones—Attempts Have Been Made to Melt Carbon, but With Indifferent Success

By SIR CHARLES PARSONS, F.R.S.

MANY theories have advanced to account for the origin of diamonds, but I propose on this occasion to confine myself to what has been done in the way of systematic researches and investigations on this subject, and to consinder whether it is possible to arrive at reliable and definite conclusions based on adequate foundations.

Henry Moissan must be credited with having been the first experimenter to make, and to identify with certainty, genuine artificial diamonds. In the "Fours Electrique," published in 1897, his researches and experiments are very fully described in minute detail. He generously alludes to the previous experiments of Marsden, published in the Proc. R.S., 1880-1881, and says he was the first to observe that if silver is melted in a carbon crucible and raised to the melting point of steel, on cooling, black diamond is sometimes found in the centre of the ingot. He moreover, states that he has repeated the experiments of Marsden and found that when a small mass of silver is quickly cooled, a satisfactory yield of black diamond results, but that transparent diamonds are never produced in silver. Moissan further adds: "The work of Marsden is of the highest interest, because he observed quite correctly the great number of different crystallized products which may be formed at the solidifying point of silver when it gives up its oxygen, alumina, silica, silcide of carbon, &c." Moissan in 1892 developed the electric furnace and applied it to his classical experiments, which resulted in the production of minute transparent diamonds in small ingots of iron, and also black diamonds in ingots of silver, when highly heated and quickly cooled in water or in chills. Moissan attributes the formation of the diamond in silver and also in iron to the compressive forces produced by the contraction of the outer layers and dilation of the molten nucleus when setting.

What occurs in a mass of iron so treated, I propose to discuss at some length, and to lay before you evidence that the gases occluded in the metal are the real cause of the production of diamond, and not the bulk pressure as has been previously supposed. We shall see that the weight of diamond found in an ingot of iron has in one case reached 1 ÷ 20,000 part of the weight of the ingot, or about 1 ÷ 1000 part of the carbon present—and that its quantity is of about the same order as the amount of carbon present as carbon monoxide occluded in the ingot. Moissan expressed the opinion that iron in a pasty condition was the matrix of the diamond, and that great pressure was the determining factor, which compelled a minute fraction of the carbon present to appear as diamond, and in his experiments he further speaks of the probability of carbon being liquefied when under a pressure sufficient to prevent its volatilization, and that from the liquid state it may pass into the crystalline or rounded form on cooling. Crookes, in his lecture delivered before the British Association at Kimberley, in 1905, emphasized the same view as to the probability of the crystallization or carbon directly from the molten state on cooling. Crookes in the same lecture also stated: "It is certain from observations I have made, corroborated by experience gained in the laboratory, that iron at a high temperature and under great pressure conditions existent at great depths below the surface of the earth—acts as the long-sought solvent for carbon, and will allow it to crystallize out in the form of diamond."

There is no prima facie reason against this view. The calories evolved in the combination of graphite and oxygen are about ½ of one per cent. less than those evolved in the combination of diamond and oxygen, indicating that graphite at ordinary temperature is, to this extent, the stable state. The bulk pressure which has operated in some of our experiments would, however, seem to have been amply sufficient to turn the balance in favor of diamond instead of graphite. The uncertainty, on the other hand, as to the compressibilities and specific heats of the allotropic forms under high pressures and at high temperatures renders speculation of little value as to what may occur at the melting point of carbon. All we know is, that up to the pressures and temperatures reached in our experiments no indication of a change from graphite to diamond has been produced.

I will now briefly describe some of our experiments which seem to bear most directly on the subject. Before doing so it is desirable first to describe the apparatus employed.

The first experiments were made in 1886 to 1888 under an 80-ton press and with current supplied from a turbo-generator of 35 horse-power; the results were given in a paper to the Royal Society in 1888. The experiments were resumed in 1907 with a new equipment which consists of a 2000-ton hydraulic

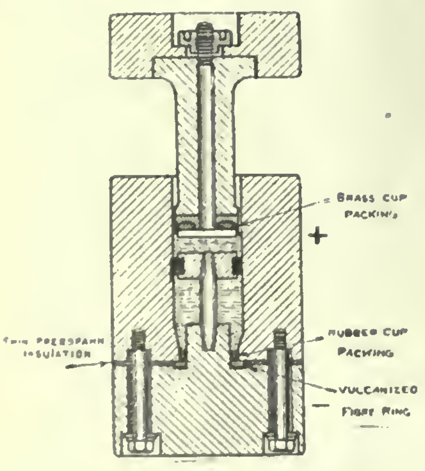


FIG. I

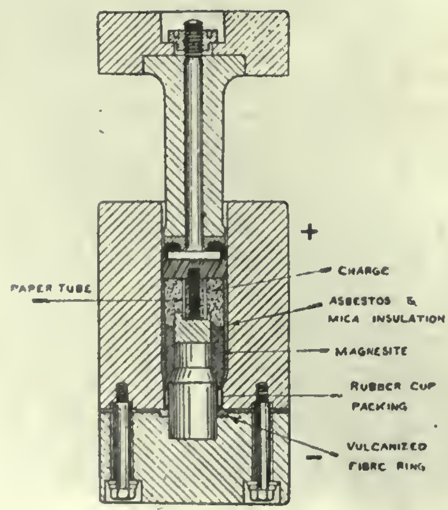


FIG. 2.

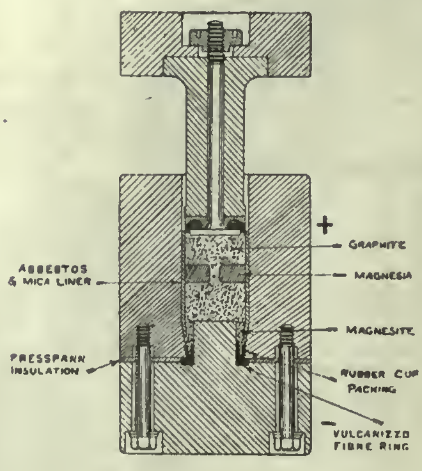


FIG. 3

press and a storage battery of 360 kilowatts normal output. The battery can be coupled for 2, 4, 8, 16, 48 volts as required, and the mains and main switch can carry currents up to 80,000 ampères to the hydraulic press, which is placed by itself in a small strong house, partly below ground, with walls of 2ft. thickness reinforced with steel bars—the door is of steel 3in. thick—the roof is of light galvanized iron. The moulds under the press are further enclosed by 2in. thick telescoping steel rings raised into position by steel ropes and counterweights. These precautions, as experience proved, were necessary, as several violent explosions occurred which cracked the steel rings and blew off the roof. A charge of iron and carbon when confined and raised to a high temperature may be very violent if suddenly released by the melting of the pole pieces. A steel mould of 9in. diameter was first used, but smaller moulds of 4in. and 2in. diameter have given satisfactory experiments and are more easily and quickly repaired and admit of higher pressures under the press. We will first consider the experiments on carbon and compounds of carbon when heated under pressure by means of a central conducting core through which an electric current is passed.

The result of treating benzine, paraffin, treacle, chloride and bisulphide of carbon, &c., under pressures up to 4400 atmospheres resulted in the production of a soft coating of amorphous carbon on the heating rod, and when the current was very intense the carbon rod and the contiguous layer were transformed into graphite. In one experiment several pounds of carbon dioxide snow were added to the charge, which consisted of magnesia, and was so arranged that evaporation of the heating carbon rod took place in an atmosphere of carbon dioxide and carbon monoxide, under a gaseous pressure of 4400 atmospheres, the condensate resulting being soft graphite. Upwards of 200 chemical reactions arranged to deposit carbon were tested under high pressure and central heating. After each experiment samples were taken from various parts of the charge and carefully analysed for diamond, the methods of the analyses generally following those of Moissan and Crookes. Small residues of diamond occasionally occurred, but the appeared to be associated with the presence of iron in the charge, whether introduced intentionally or from the melting of the pole pieces, short circuits, or from other causes. On the whole, there was no evidence that diamond had been produced by any of the chemical reactions, some of which were violent and caused explosions, and expanded the container. Some were endothermic, such as carborundum and sodium carbonate, which produced a grey solid which detonated.

We now pass on to consider the experiments designed to melt carbon in bulk, and I deal with them in some detail because so much prominence has hitherto been given to this aspect of the question. The barriers used were composed of quick-lime, marble, titanium oxide, or magnesia calcined in the electric furnace; of these magnesia gave the best results, being the more slowly converted into carbide. Intense heat was applied in one experiment for 5 sec., but sufficient in amount to melt the graphite core six times over, the only result being a slight alteration of the structure of the graphite. Threfall independently came to the conclusion from his experiments at about the same time (1907), that under 100 tons, or 15,000 atmospheres pressures per square inch, graphite, electrically heated, remained graphite. It appeared, however, desirable further to investigate the possibility of carbon losing its electrical conductivity when approaching its melting point, as alleged by Ludwig and others, and of shunting the current from itself on to the contiguous molten layers of the insulating barrier surrounding it. There had, however, been no indication of such a change having occurred, even momentarily; it rather seemed that the graphite core had been partially vaporised and condensed in the cooler parts of the charge. The experiment was, however, repeated with rods of iron and tungsten imbedded in the core, so that should the temperature of volatilisation of the metals under a pressure of 12,000 atmospheres exceed that necessary to liquefy carbon under the same pressure, the presence of these metals might produce a different result| No change, however, occurred, though in one experiment the pressure was raised to 15,000 atmospheres. A different method of attack was then arranged which would ensure that carbon should be subjected to an extremely high temperature concurrently with high pressure, obtained by the rapid compression of the hottest possible flame, that of acetylene and oxygen, with a slight excess of the former to provide the carbon. The arrangement was as follows:—A very light piston made of tool steel was carefully fitted to the barrel of a duck gun of 0.9in. bore; the piston was flat in front, lightened out behind and fitted with a cupped copper gas check ring, the cup facing forward; the total travel of the piston was 36in. To the muzzle of the gun was fitted a prolongation of the barrel formed out of a massive steel block, the joint being gas-tight. The end of the bore in the block was closed by a screwed-in plug made of tempered tool steel, also with a gas-tight collar. A small copper pin projected from the centre of the plug to give a record of the limit of travel of the piston. The gun was loaded with 2 drachms of black sporting powder, which amount had been calculated from preliminary trials. The barrel in front of the piston was filled with the mixture of acetylene and oxygen. It was estimated that this mixture would explode when the piston had travelled about half-way along the bore; when fired the piston travelled to within ⅛in. of the end, as had been estimated, giving a total compression ratio of 2888 to 1. As a result it was found that the surfaces of the end plug, the fore end of the piston, and the circumference of the bore up to ⅜in. from the end of the plug had been fused to a depth of about .01in., and were glass hard, the surface of the copper pin had been vaporised, and copper sprayed over the face of the end plug and piston. The end plug, which had been hardened and tempered to straw colour, showed signs of compression, and the bore of the block for ⅜in. from the plug was enlarged by .023in. in diameter, both indicating that a pressure above 15,000 atmospheres had been reached.

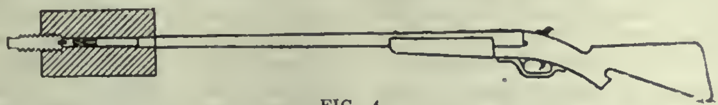


FIG. 4.

A little brown amorphous carbon was found in the chamber, which was easily destroyed by boiling sulphuric acid and nitre, there was no diamond residue from this. There was, however, a small crystalline residue from the melted layer of the end plug, from which was isolated one non-polarising crystal, probably diamond, but too small to identify with certainty. Considering the light weight of the piston and the short duration of the exposure of heat, the small diameter and volume of the end clearance space, the effects would seem to indicate that a very abnormal temperature had been reached, many times greater than exists in the chambers of large guns. There was, however, no evidence of any melting and re-crystallisation of the carbon present. A calculation made by Mr. Stanley Cook, based upon the ratio of

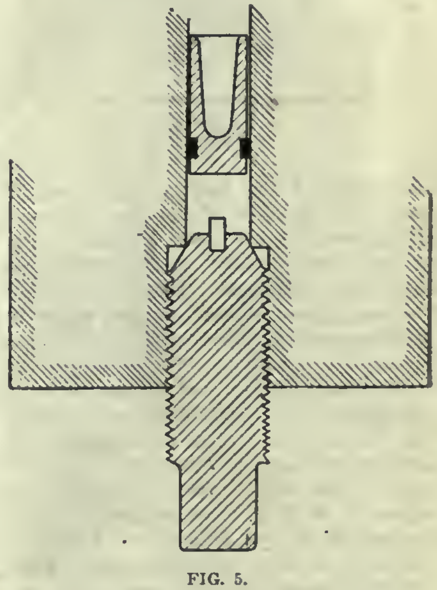


FIG. 5.

compression and a final pressure of 15,-0000 atmospheres, indicates that a temperature of between 15,250 deg. Cent. and 17,700 deg. Cent. was reached, the exact temperature depending upon the amount of dissociation or combination existing between the elements at the time.

It seemed desirable to try the effect of still higher pressures, so a rifle, .303 bore, was fitted with a specially strong breech mechanism by Rigby, capable of withstanding a charge of cordite 90 per cent. in excess of the service charge.

The gun was fixed with its muzzle 6in. from a massive block of steel, in which a hole, 303 diameter, had been drilled to a depth somewhat greater than the length of the bullet, and in alignment with the bore of the gun; cylindrical bullets of steel, with a copper driving band, were chiefly used, shorter than the service bullet, and about one-half of the weight, some with cupped noses to entrain material, some with coned noses to match the bottom of the hole in the block. The velocity with 90 per cent. excess charge was estimated to be about 5000 ft.-seconds. The substance to be compressed was placed either at the bottom of the hole when a conical-nosed bullet of mild steel was used, or over the mouth of the hole when a cupped-nose of tool steel was employed. About 100 experiments were made. The substances tested included graphite, sugar carbon, bisulphide of carbon, oils, &c., graphite and fulminate of mercury, finely divided iron and fine carborundum, olivine and graphite, &c. After each shot the bullet and surrounding steel were drilled out, and the chips and entrained matter analysed.

Several experiments were also made with a bridge of arc light carbon placed over the hole and raised to the limit of incandescence by an electric current, and the shot fired through it into the hole at the moment the carbon commenced to vaporise, as observed in a mirror from without. Also an arc bebtween two carbons was arranged just over the hole, and the shot fired through it.

Of all the experiments only two yielded a reasonable amount of diamond residue, one made with graphite wrapped in tissue paper, the bullet, however, in this case having grazed the side of the hole, and thus producing some molten iron by the friction; the other with the incandescent bridge, where again some molten metal would probably occur. The residues were in all cases exceedingly small, and not more than would be produced from a very small amount of iron melted, carburised, and quickly cooled.

There was no evidence of any incipient transformation of carbon in bulk into diamond that could be detected by analysis.

The pressure on impact of steel bullet fired into a hole in a steel block which it fits is limited by the coefficient of compressibility of steel, and with a velocity of 5000 ft.-seconds is about 2000 tons per square inch. Measurements made from a section through the block and bullet showed that the mean retardation on the frontal face after the impact till it had come to rest was abobut 600 tons per square inch.

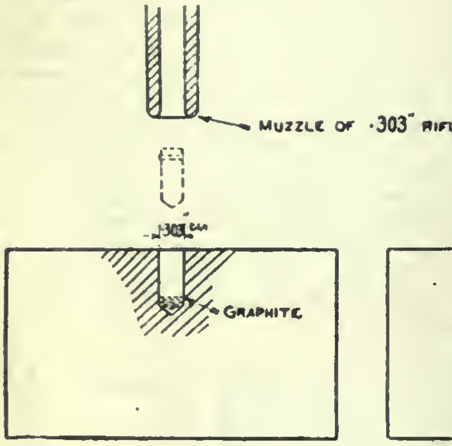


FIG. 6

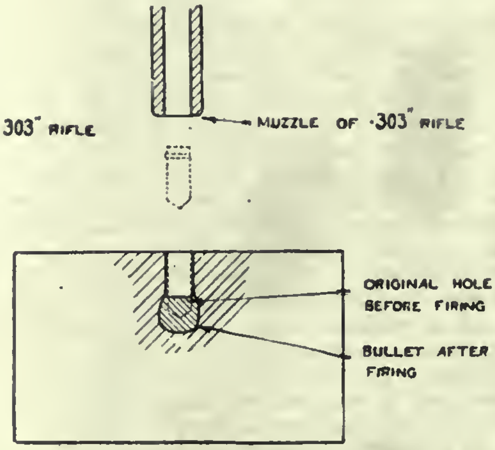


FIG. 7 .

Several experiments were made by substituting a tungsten steel block, and a hole tapering gently from .303in. at the mouth to .125in. at the bottom. The mild steel bullet was deformed by the tapered hole, and a greatly increased velocity imparted to the nose. Progressively increased charges were used ,and even with relatively small chargs the block cracked on the second round. With the 90 per cent. excess charge, the block always split on the first shot, but this probably occurred after impact, and not till the full instantaneous pressure had been exerted, which was estimated to be greater than with the plain hole, probablby exceeding 5000 tons, a pressure about equal to that at the centre of the earth.

In these latter experiments graphite was placed at the bottom of the hole. The analysis yielded nothing but graphite.

Experiments on Pressure in Cast Iron When Cooled.

It has been generally assumed that iron rich in carbon expands on setting, and that this supposed property is a contributory cause in the formation of diamond by increasing the pressure in the ingot.

We made several experiments by pouring iron, saturated with carbon, from the electric furnace through a narrow git into a very massive steel mould, closed at the bottom with a breesch screw—Fig. 9. When cold the breech screw was easily removed, and there was no sign of there having been any appreciable pressure on the threads. Not being sure that, because of capillarity, the corners of the mould had been quite filled, a steel mandril was, immediately after pouring, forced down the git hole by a press giving a fluid pressure in the mould of 75 atmospheres. The observed pressure on the breech screw appeared not to have exceeded this pressure. Highly carburised iron, therefore, does not expand with any considerable force on setting.

The reason why a lump of cast iron thrown into a ladle of molten metal first sinks to the bottom and soon rises and floats on the surface is probably that cast iron is about seven times stronger in compression than in tension. Therefore, when a sufficiently thick layer of cold metal has been heated, the interior is torn asunder by the expansion of the outer skin, and the specific gravity of the whole mass is diminished.

We may, therefore, safely conclude that when iron is suddenly cooled, the only compressive bulk pressure that is brought to bear on the interior is that arising from the contraction of the outer layers after setting, and with highly carburised iron this can only be moderate because of the low tensile strength of the metal, and cannot exceed about 1000 atmospheres.

Moissan observed that spherules or globules of iron with cracks never contained diamond. To such he attributed a loss of mechanical pressure; we now think that they merely provide an outlet for the occluded gases from the metal. We have made experiments by pouring highly carburised iron and alloys of iron on to iron plates, the cooling taking place from one side only, and under such conditions no diamond results; in fact ,it only occurs when the ingot or spherule is cooled on all sides simultaneously so that a gas-tight skin is formed all over before the centre is cooled.

Since my paper to the Royal Society, in 1907, the experiment of heating iron in a carbon crucible, and transferring it to a steel die, and subjecting it to 11,-200 atmospheres, has been repeated, this pressure being many times greater than can occur in a cooled ingot, and it has been found that if the iron is allowed to set bebfore the pressure is applied, the amount of diamond is much greater than if pressed when very hot, and while still molten, and that under the former condition it is about the same as when the crucible is cooled in water. The only reason that suggests itself to account for this is, that when pressure is applied, dwhile very hot, some of the iron permeates the carbon of the crucible, and because of the greater specific heat and lesser conductibility of the carbon, the iron next to and in the carbon remains molten after the ingot has been cooled from the top by direct contact with the steel cup on the face of the plunger; thus when cooling, the occluded gases have a free exit from the ingot through the molten metal (which is pervious to gas) into the carbon of the crucible, and are not retained in the ingot to the same extent as when it has set before pressing, and is enclosed on all sides in an envelope of iron impermeable to the gases.

These experiments, I think, it will be agreed, dispose of the bulk-pressure theory of the production of diamond in cooled iron. In fact, none of our experiments have shown that bulk-pressure has any effect whatever on the production of diamond unless in so far as it may affect the amount and distribution of the occluded gases within the ingot. Several experiments were made to try

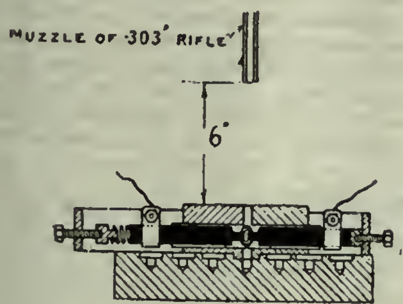


FIG. 8.

the effect of extremely quick cooling, by transferring a crucible with a charge of iron from the electric furnace to the press and submerging it in carbon dioxide snow, and also in water, at 6000 atmospheres—the analysis showed very little diamond. Other experiments where extremely quick cooling was effected not under pressure confirmed the view that quick cooling as such is not a factor in the production of diamond ,and that carbon is not caught in a state of transition by quick cooling.

Experiments were made on oxidising alloys of iron by superheated steam after heating in the electric furnace; large residues of crystalline oxides of the metals of the alloys resulted as had been observed by Marsden in silver, and there also was a small percentage of the residue (about 5 per cent.) of very minute crystals which burnt in oxygen, and had a specific gravity of 3.5, and are, therefore, diamond.

This part of the subject appears to merit further investigation.

Experiments Under Vacuum.

The presence of diamond in some meteorites suggested a series of experiments under various degrees of vacuum up to the highest obtainable.

It seems probable that in past ages some meteoric matter may have been melted by collision or ejected into space in a molten space and cooled by radiation, and that under such conditions absence, or diminution, of occluded gases might be a factor conducive to crystallisation of diamond.

More than fifty experiments were made with electrical heating of a carbon crucible under vacuum. Fig. 11 shows the first container used, which was evacuated to about 1-6 mm. of mercury by three steam jets in series with an air pump and jet condenser.

This apparatus was subsequently replaced by a molecular air pump of very large capacity working in series with two other pumps, which could maintain an X-Ray vacuum during the whole of an experiment. Fig. 12 shows the container. The suction outlet to the pump is 18in. in diameter.

When in this apparatus iron and alloys of iron were heated under high vacuum, the large volume of gas given off by the metal was very striking, and unless the heating was very gardual much of the metal was ejected from the crucible. It became quite apparent from the experiments that metal ejects the occluded gases slowly and absorbs them slowly. It was remarkable that in no experiment under a vacuum higher than 2 mm. was diamond ever found in the ingot crucible, but it was found in the ejected iron which had not fully parted with its occluded gases. Here again we have impressed on us by these experiments that occluded gases are essential to the production of diamond in cooled iron. Experiments were made under low vacuum—Fig. 10—averaging about 1in. of mercury, the gas in the container being 95 per cent. carbon monoxide. The heating up was prolonged and the cooling was effected solely by radiation and convection, and was relatively slow, occupying 15 sec. from switching off the current to the setting of the metal. Some of the diamonds produced in this way, the largest measured 0.7 mm. in length.

Let us for a moment recur to the experiments designed to impose the greatest possible bulk pressure on carbon and also on iron. The experiments designed to melt carbon have been carried up to 15,000 atmospheres steady pressure, and to 300,000 atmospheres momentary pressure, which pressures are nearly up to the maximum possible with the materials at our disposal. 300,000 atmospheres, or 2000 tons per square inch, is about one half the probable pressure at the centre of the earth—but only a fraction of one thousandth's part of the pressure at the centre of large stars or also of the pressure produced by the impact of large bodies in space. By such collisions and intense heating and cooling, short or prolonged, of large masses might occur by the adiabatic compression of the central portions of the colliding bodies. Under such conditions the Moissan effect might be produced on a large scale, and if heating and cooling of iron are the only essential conditions, would result in the production of large diamonds. One source of diamond may, therefore, be attributed to prehistoric falls of meteorites. The artificial reproduction of such conditions is obviously beyond our reach. Up to the present, as we have said, the only proved source of artificial diamonds is from iron or silver intensely heated, and then cooled with more or less rapidity. I now pass on to further consideration of this question.

We have seen that the evidence is very strong, or perhaps conclusive, that the occluded gases which escape on the setting of the metal and during cooling are a vital factor, and that unless such gases are retained within the ingot no diamond results. We have further seen that great pressure on the metal when molten and cooling makes no difference in the yield, also that the retention of the occluded gases is in this case likewise essential. The experiments under vacuum have shown that if the metal

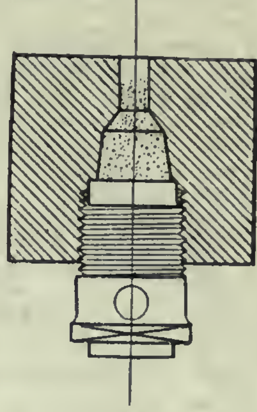


FIG. 9.

has had time to lose its occluded gases no diamond occurs, so that we may conclude that under all bulk pressures on the metal occluded gases are an essential factor.

Let us consider what happens inside an ingot or spherule when rapidly cooled simultaneously on all sides. It is first surrounded by a thin coating of solidified metal, which below 600 deg. Cent. is nearly impervious to gases. As the coat thickens, layer within layer, more and more gas is ejected by the solidifying metal, and is forced inwards, the diminishing nucleus of molten metal and its semi-solidified centre layer still pervious to gas receives the charge, and as this process progresses the pressure may rise higher and higher, though there may be a limit to the pressure against which the metal is able to eject gas when setting. All we, however, know is that the mechanical strength of the ingot or spherule places a limit of about 1000 atmospheres to the gaseous pressure when concentrated into a small nucleus. In the case of some iron alloys which occlude more gas than iron, most of the spherules are split or shredded with an appearance consistent with this view.

It would seem that the chief and only function of quick cooling in the production of diamond in an ingot or spherule is to bottle up, and to concentrate into local spots within it, under high pressure, the gases occluded in the metal which, during slow cooling, would partially escape, while the remainder would become evenly distributed throughout the metal.

Crookes' microscopical examination of diamonds with polarised light supports this view. I now quote a passage from his lecture at Kimberley in 1905. He says: "I have examined many hundred diamond crystals under polarised light, and, with few exceptions, all show the presence of internal tension. On rotating the polariser, the black cross most frequently seen revolves round a particular point in the inside of the crystal; on examining this point with a high power, we sometimes see a slight flaw, more rarely a minute cavity. The cavity is filled with gas at enormous pressure, and the strain is set up in the stone by the effort of the gas to escape."

Diamonds appear to be formed in the metal after it has set. Moissan found that the diamond occurred near the centre of the ingot, and he remarks that natural diamonds must have been formed in a pasty matrix, because they never show evidence of attachment to a hard body. But the most conclusive proof seems to be that we have found that a diamond is rapidly corroded by highly carburised iron just before setting, so that a microscopic diamond could not exist in molten metal for a second.

On the whole I think that diamond is probably formed at a temperature of about 690 deg. Cent., one of the points of recalescence, while the metal is still somewhat pervious to gases.

A heat treatment at high temperatures in the electric furnace appears to be essential ,and it is probably required to form carbides, within the mass, other than those of iron, and which react with the occluded gases after solidification. The view that carbon monoxide is the most important of the occluded gases is supported by the increased yield of diamond from iron which has absorbebd much of this gas before cooling, and also by the fact of its combination with the metals, and also with silica and sulphur as carbonyls. Its remarkable action in association with iron on carborundum appears further to emphasise this view. In this connection Carpenter observed some years ago that the gases given off from cast iron at red heat under high vacua contained silica. We have seen that in rapidly cooled iron the occluded gases must be much compressed at the time the diamond is formed, and Mond has shown that pressure, in the case of iron, increases the yield of ferro carbonyl ,and also is essential to the formation of the carbonyls of some other metals.

There is strong evidence to support the view that the action may take place solely between iron carbobrundum, sulphur, and carbon monoxide. It is, however, probable that other metals may also be involved, and that the action is one of great complexity. It must always be remembered that the yield of diamond is extremely small, and therefore very small traces of some of the elements may suffice to satisfy the action. Very little is, however, known and patient experimental research has here a most attractive field. As I have said, the largest percentage of diamond we found in cooled iron was estimated to be 1 ÷ 20,000 the weight of the iron, and 1 ÷ 1000 part of the carbon present, and if we assume that the iron contained a volume of carbon monoxide equal to .69 of the volume of the ingot—a common proportion — the weight of carbon in the carbon monoxide exactly equals the weight of diamond. The yield of diamond from the South African Blue Ground of the De Beers Mine in 1904 was 1 ÷ 5,400,000 of the weight, so that the yield from cooled iron in the best experiment has been 270 times greater.

I am not disposed to speculate, but may venture to suggest that it would seem probable that if a large mass of iron ,alloyed with other elements, was submitted to suitable heat treatment, and after setting, but when still at a temperature permeable to gas, was subjected to carbon monoxide at a pressure of about 1000 atmospheres for a long time that segregations might take place slowly within the mass, and diamonds in payable quantity and size might be produced. This experiment virtually consists in replacing the cold metal envelope thrown around the ingot by a gaseous envelope at a superior pressure, which will not only imprison the occluded gases, but further, by the ingress of additional gas into the metal, may induce the formation of diamond throughout the whole of the ingot. It may be found that higher gaseous pre sures than those permissible in a cooled ingot may increase the yield, and if is found to be the case they can be easily applied.

In rapidly cooled iron there is a steep temperature radient in the metal, but when under gases at high pressure it seems probable that the natural tendency to segregation on slow cooling may suffice to determine the local concentrations which form diamond.

The presence of crystals of silica, alumina and magnesia ,and the spinels and pyrope, &c., associated with diamond in rapidly cooled iron alloys, and also when oxidised by steam, appears to have a bearing upon the presence of similar crystals generally found in association with diamond and merits further investigation. The solution which I have indicated appears to be compatible with the conclusions of Bonney that eclogite is the parent-rock of the diamond in South Africa. He says: "Thus the diamond has been traced up to an igneous rock. The blue ground is not the birthplace either of it or of the garnets, pyroxenes, olivine, and other minerals, more or less fragmental, which it incorporates. The diamond is a constituent of the eclogite, just as much as a zircon may be a constituent of granite or a syenite. Its regular form suggests that it was the first mineral to crystallise in the magma." The solution we have suggested also accounts for so small an amount of carbon having escaped oxidation, for according to our view both the diamond and the eclogite have ben crystallised in iron at comparatively low temperatures.

It is possible that there may be other feasible solutions to the problem. For instance, it is possible that at a suitable temperature carbonic oxide under high pressure might cause diamond to crystallise in olivine, blueground, or eclogite, if some of the constituent elements were present, as metals and carbides, with some it would form carbonyls, and with others it would react.

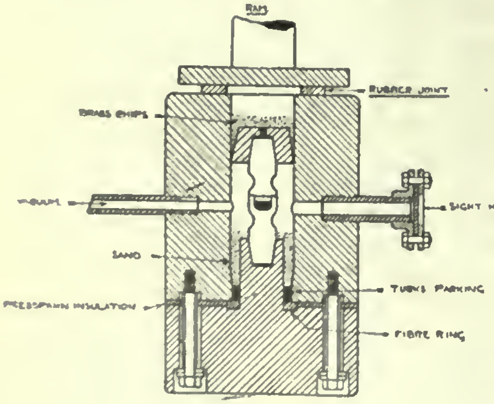


Fig. 10

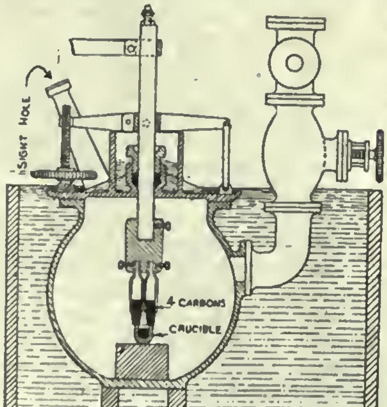


FIG. 11.

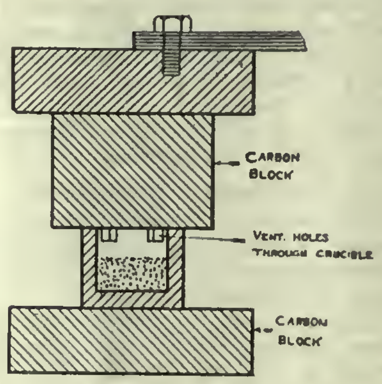


FIG. 12.

A Modern Machine Shop and Its Management

The Proper Layout of the Plant Has Much to do With the Success or Failure of the Operations Carried on There—Essentials That Should be Kept in Mind in Constructing Shop and Tracks

No. 1 in Series of Articles by M. H. Potter.

GENERAL PLANS AND ARRANGEMENTS

As a rule the amount of land is limited and therefore a compact form is necessary. The compact form, capable of easy expansion in any direction, is chosen as likely to be the most useful one to those desiring information on this subject. The handling of materials and the transportation of them is made as simple, direct and economical as possible.

A railroad track should pass near the works, and from it a branch should be brought past the rear and to one side of the collection of buildings. Such an arrangement results in a great saving in the expense of hauling both material and product, and permits the general arrangement and development of the plant as here described.

Main Building

The main building or machine shop is divided lengthwise into a central portion, with side bays. The central portion is open clear to the roof and has a traveling crane of ample capacity moving over its entire length. The side bays are divided into a main floor, on a level with the central portion, and a gallery or second floor. This gallery is extended across the front end, thus connecting the two galleries and furnishing a platform by way of which the traveling crane may transfer material and product to and from the main floor. Along the center of these galleries and across the front runs a tram track, provided with light push cars for facilitating the transfers. Stairways are provided at each end in the center for conveniently and speedily reaching any part of the shop from floor to galleries.

At the front end of the machine shop proper are the offices connected with and forming a part of it, consisting of two structures with a driveway space between them. On the first floor of these are the offices, storerooms, etc., and in the other the tool-making room, a room for storage tools and fixtures, and a stock room, for the small finished parts. On the second floor is located the drawing room, while over the driveway is the pattern shop.

The offices are only those particularly connected with the manufacturing and shipping, and not the general offices of the company. A wing connects the front buildings with the foundry. The ground floor of this wing is used as a storage room for pig and scrap iron, and a flask room, while the second floor is a pattern storage loft, connected at one end with the pattern shop and at the opposite end with the foundry by a trap door directly over the train track leading through the flask room.

Foundry

The foundry is arranged with a central part and two side bays. The central part is covered by a traveling crane running the entire length. There are two cupolas, a large and a small one, served by two cranes of sufficient reach to swing into the central space covered by the traveling crane.

Large work is cast in the central space or within reach of the cranes, while small work and bench moulding occupy parts of the floor not covered by the cranes. On each side of the central part are tram tracks, which are crossed by one running to the flask room and one that goes through the chipping room and on across the yard to the machine shop.

A bay built on the side of the foundry toward the machine shop contains a platform upon which coal and iron for charging the cupolas are delivered by a tram car raised to that level by an elevator arranged for the purpose. This stock is weighed on track scales in front of the elevator. Beneath the cupola platform are the tumbling barrels, convenient to the cupolas for working over the slag, and to the chipping room for cleaning small castings.

The flask room is located at the front, while between it and the tumbling barrel space is the core room, containing a suitable core oven. At the opposite end, facing the yard, is the chipping and pickling room, where the castings brought in from the foundry are pickled, chipped and weighed, before being sent to the machine shop. If the castings are too heavy for convenient handling in the chipping room they may be run through to the yard and there handled by a boom crane covering the tram track upon which they are run into the machine shop. Castings of moderate size, yet too heavy to move by hand, are expeditiously handled by a light overhead trolley hoist in the chipping room.

At one end of the outer bays are the wash room and toilets.

Forge Shop

In the further corner of the yard, as far as possible from the foundry and engine room, is the forge shop, which is reached by tram cars, the track running through its length near the center. On the outer walls are the chimneys for the forges and heaters, and in the rear are the storage sheds for bar iron and steel, and space for coal. These adjuncts are in a shed built with brick walls and of such outline as to conform somewhat to the curve of the railway track, the forge shop having been so located as to admit of this arrangement.

Power House

The power house is located midway in the length of the machine shop, so that power may be applied to the line-shafting at a point that prevents much of the torsion incident to long lines of shafting driven from one end.

Near the boiler house is the chimney stack, with which the smoke flues of all the boilers are connected. Coal is brought in on push cars along the tram track, to the front of the boilers, where a track scale is placed for weighing it. Ashes are removed by the same tram track to whatever point is most desirable to deliver them.

Store House

Across the yard, at the rear end, is a store-house, for finished machines, or product. This connects with the rear end of the machine shop by a tram track running from the scales beneath the traveling crane through a wide doorway and the entire length of the store-house. The rear side of the store-house (next to the railway track) has wide, sliding doors, through which the finished product is readily moved into the railway cars for shipment. Here, as in the chipping room of the foundry, it may be desirable to make use of overhead trolley hoists to facilitate rapid and economical handling of machinery to be shipped. A space is left between store-house and forge shop for a branch of the tram tracks, as a convenient means of receiving material from the railway at this point.

Carpenter Shop

Adjoining the store-house is a carpenter shop. Thus the men who prepare the finished machinery or product for shipping are near their work, and the lumber used for this purpose, and the necessary machinery for cutting it up, are close at hand and require no unnecessary handling.

In the angle formed by the store-house and carpenter shop are the storage sheds for cast iron and steel chips from the machine shop, or for similar material.

Along the side of the yard extending from the forge shop to within 20 feet of the foundry, are arranged the stock sheds. These hold foundry sand and coal, engine coal, coke, etc., which is delivered into them directly from the railway cars, the track being raised to the proper grade after it has passed the store-house. It is continued the whole length of the foundry so as to deliver foundry sand directly into the windows of the foundry, keeping that in the storage shed as a reserve supply. Between the storage sheds and foundry is a gate, through which may pass a branch of the tram car track for receiving stock and material from the railway cars at this point.

Provision for Expansion

Whatever may be the size of the buildings of a manufacturing plant, or however carefully provision be made for all necessities for handling materials, etc., there is always the possibility, that some day the works will have to be increased in capacity or changed in form.

It is, therefore, important to consider these points at the outset, and to provide for an expansion of the business in accordance with future needs, and at the same time not disarrange or break up the general plan of the works. With these points in mind, the two following plans are given for enlarging the machine shop when more room is needed.

First, the building may be extended to the rear across the railway track, the rear wall being removed and the traveling crane tracks continued through the length of the additional building. Doors are provided for the passage of cars upon the railway track, and also a specially-built car habitually used for connecting the floors of the old and new building, its platform being on a level with the two floors. Thus the machine shop capacity could be increased to any reasonable extent.

Second, one, two or three bays may be built at right angles to the machine shop and on the side opposite the power house. These might be of one or two stories and of any desired length. They may contain traveling cranes to convey material to and from the traveling crane of the main shop, or have convenient trolley hoists and train car tracks, according to the character of the work to be done.

The capacity of the foundry may be increased one-third by extending it toward the power house. The same space may be obtained by using for foundry space that provided for chipping, core, and flask rooms, and providing space for the latter by extending the building toward the machine shop. The space, occupied by the wash rooms and toilets will, of course, be taken also, and these rooms placed in the gallery, as heretofore suggested.

To obtain additional power space for these enlargements the space occupied by the wash rooms and toilets may be utilized and these rooms provided for in an addition built toward the carpenter shop.

By some one of these plans or a combination of them, the capacity of the works may be at least doubled without seriously disturbing the general plan here described and without impairing the general efficiency of the facilities for handling the work.

This design is in as compact a form as is advisable, with a view of sufficient yard space. Where the amount of land is ample it would be manifestly desirable to spread out the design more by increasing the distance between the machine shop and foundry at the front, and the store-house and forge shop at the rear, or by lengthening the machine shop and thus add to the yard room.

Either of these plans might be employed where the extent of ground would admit of it, as it is always important to have plenty of room when it is possible, and it is seldom that we have too much yard space.

The newest form of shop roof should be of interest, as it tends towards perfect illumination and utility.

Appearance, uniformity, and symmetry have given way to practical usefulness, the object being to secure perfect, or rather as near perfect as obtainable, equal illumination over the entire floor, whether the buildings are large or small.

This has been one of the difficulties not entirely overcome, and in consequence of this drawback it has not been possible to construct buildings beyond a certain width, owing, in this respect, to a dark zone along the center. With this new method of lighting we may practically make them as wide as desired and be assured that the central portion is, for all practical purposes, as well lighted as near the side walls. This is a great advantage in buildings in which large machinery is to be constructed, as this class of work may be much more economically built in shops having but one storey; and as the earth furnishes the best foundation for a floor for heavy weights, this is desirable on that account.

grees, and the glazed portions an inclination of about sixty degrees.

Fig. 1, is a longitudinal section and Fig. 2, a cross-section of a machine shop with this type of roof. In Fig. 3, is given a perspective view of the machine shop completed, showing the general arrangement of the high central portion and the lower portions at each side.

The plan of the building shown is provided with a high central space for an erecting floor, over which a traveling crane is mounted, covering every part of this floor. The side portions are built considerably lower, as the same height is not here necessary or desirable. These portions are provided with smaller traveling cranes, running upon I-beams or girders which project into the central space, so that these cranes are capable of depositing their loads within the reach of, and under the main crane.

If much heavy work is to be done, each of the bays, on both sides of the central portion, is supplied with one of these cranes. By this means any load may be quickly and conveniently transferred from any one point, within any one of the bays to any point within any other bay, or to any point in the central erecting space, by the combined use of the main and secondary cranes.

In many cases it will be necessary to have these secondary cranes on one side only of the central space, the other side portion being reserved for machines and

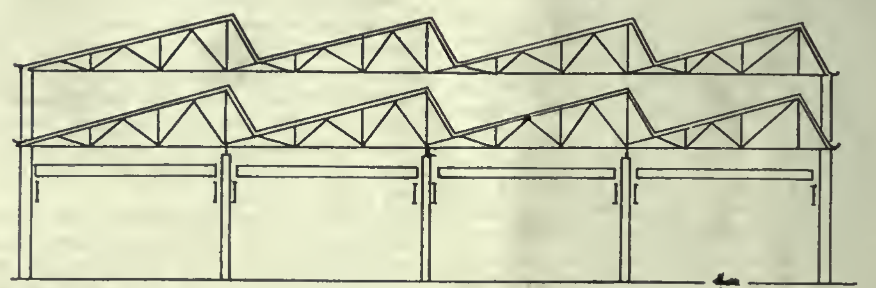


FIG. 1.

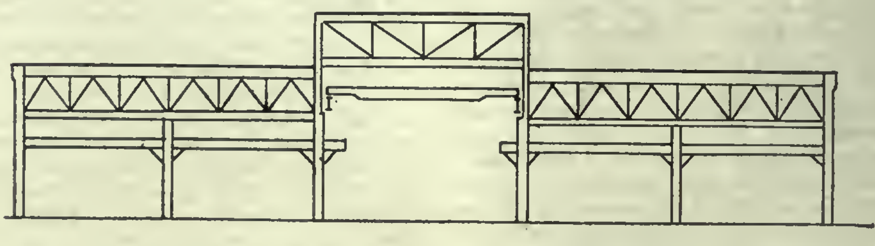


FIG. 2.

For this class of work a large area is needed, and to construct comparatively narrow buildings in order to have the center of the room well lighted, is expensive as well as inconvenient in moving large machines, or in working around them.

By this method of construction the buildings may be very broad and low and consequently easy to heat, and, as has been said, with good illumination over the entire floor.

The essential feature of the saw-tooth construction consists in forming the roof in broken sections, the roof proper having an inclination of about fifteen de-

work of the lighter description. So, also, it may not be necessary to equip all the bays on one side, even, with secondary cranes, while it may be necessary, and very convenient, to so equip several bays in this way. The nature of the work may be such that it will be convenient to equip several bays on each side and at one end with secondary cranes so as to arrange all the heavy work across the end of the shop, instead of along the side.

Fig. 1, shows the most approved form of truss for supporting this type of roof, and Fig. 2 gives the form of girders used to support the ridges of the roof where the glazed portion joins the roof proper. This construction is of light structural steel and no more members are used than is absolutely necessary, hence the entrance of light is very slightly interrupted and still there is sufficient strength for all practical purposes. The glazing of the light portions should receive much attention, in order to avoid leakage, as this is always one of the drawbacks of any kind of inclined windows.

For purposes of ventilation the sashes may be hinged at the top and opened by any convenient means. A simple device is to run a light shaft along inside the building and near the bottom of the sashes, and fix to it cast iron arms, in the form of cranks, for each sash. From these arms connecting rods run to the sashes. This shaft may be operated by fixing to it a grooved pulley, over which a small rope runs, and reaches down near the floor, from which it may be operated.

Ribbed glass should be used in these sashes as it prevents the glaring effect of direct and unimpeded sunlight, and diffuses a soft and agreeable light over the whole area to be lighted.

The roof timbers should be secured to the walls and to the posts by anchor bolts, to prevent the roof being lifted by high winds. In putting on the roof planking for this type of roof different methods must be adopted for the steel construction from that used for wood trusses and roof timbers.

In the case of the steel trusses, the supporting bars are shown in solid section in the longitudinal section, Fig. 1, and to these the planks may be secured by bolts, or lug screws, if steel supports are used, or by spikes, if these supports are of wood. In either case the planks will run in the direction of the pitch of the roof.

If the wood construction is used, the rafters will not be over 10 feet centers, and the planks long enough to reach at least two spaces, or 20 feet, ,and are spiked directly to the rafters, consequently they will run at right angles to them.

In case of either steel or wood construction, the roof planks should be covered with a good resin-sized roofing paper, mopped with hot tar, and upon this a heavy quality of roofing tin, or some form of the modern sheet steel roofing. All sheet metal should be painted on the under side before it is laid.

The gutters or valleys of these roofs should be the subject of careful attention. They need not be of sharp pitch, as a quarter of an inch to the foot will be sufficient. Conductor pipes at each gutter should carry off the water. In the case of the shop shown in perspective in Fig. 3, the gutters on the high central portion should incline each way from the center and from each side, conductor pipes carrying the water to the gutters in the lower part of the building, and from thence it flows to the conductor pipes at the sides.

Both of the methods above described for constructing the roof will be found economical to build and well adapted to the purpose for which they are to be used.

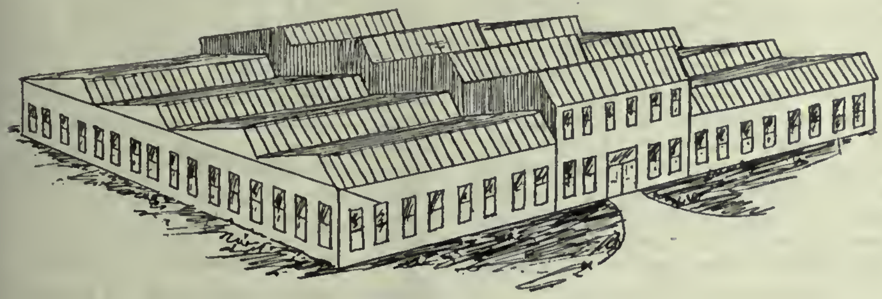


FIG. 3.

DEVELOP FLUORSPAR MINE IN B.C.

"The Consolidated Mining & Smelting Co. have started development of the fluorspar deposit which they bonded on the north fork of the Kettle river," writesA. E. Haggen. "This is one of the most important mineral discoveries recently made in the province of British Columbia. It is used in the manufacture of hydrofluoric acid, of which a large amount is consumed in the electrolytic lead refinery at Trail, and as a flux in silver-lead and copper ores. With the establishment of the iron and steel and glass-making .industries in British Columbia the existence of fluorspar will prove of great value. In the smelting of iron and steel fluorspar and phosphorus contents, and increases the tensile strength of the metal. Other uses are in the manufacture of spiegeleisen, foundry work, cupola, furnaces, manufacture of enamels, glazes, fireproof ware, apochromatic lenses, gems and carbon electrodes folr flaming arc lamps, so that the discovery of this deposit is not only of value in existing metallurgical industries, but in the future industrial development of the province. A good deal of the mineral has already been packed out on horses, but a road is being built to connect the deposit with the railway, a distance of about eight miles.

"'A tunnel is being driven on the Molly Gibson at Paulson. This property carries an appreciable amount of platinum in addition to the other mineral values."

STEEL SITUATION IN JAPAN

The steel rolling mill of the Kawasaki Dockyard Co. at Fukai, Kobe, will begin operations in a few days. The plant has a capacity equal to turning out 125 tons a day.

The Hokkaido Steel Works has completed the installation of a smelting furnace with a capacity of 100 tons a day. The new furnace was to start operations on Saturday, June 15.

It is reported from Osaga that France and Italy have started their purchase of Japan zinc, thereby enlivening the market here, which has been short of the visible stock on account of the curtailed output of refiners.

Big zinc refiners in Japan, including the Mitzui Co., Suzuki & Co., and others, are going to boost up prices of zinc by their united action to cut down the output. The probable extent of reduction is 25 per cent., it is said.

WOOD SHIPS FOR AUSTRALIA

The Canadian government has received an interesting statement in regard to the present position of shipbuilding by the Commonwealth of Australia. Actual contracts entered into by the government include 26 steamships and twenty-four wooden ships, with a gross tonnage of 200,600 tons. Twenty-seven distinct slips are bieng used for construction purposes. When these contracts are completed the Australian government will own a total fleet of seventy-seven vessels of a gross tonnage of 302,506 tons. Of this number fourteen vessels have been purchased in England and fourteen are being built in the United States.

At least one Nova Scotian vessel will, in all probability, be purchased by the Commonwealth government within an early date. The report states that as it is impossible to obtain adequate supplies of wire rope and the favored hemp sail canvas from the United States, the attention of Canadian manufacturers of these articles is directed to the development of Australian shipbuilding as an outlet for their products.

FLINT AND TINDER AGAIN

The manufacture of tinder-box flints is booming just now owing to the match shortage.

This is probably the oldest handicraft in Britain—older, in fact, it could hardly be, for it forms an industrial link—the only one—with the prehistoric Stone Age.

The centre of the industry is the little village of Brandon, on the borders of Norfolk and Suffolk. The men who pursue it are known locally as flint-knappers, and the work is done in little sheds, often situated at the back of the cottages in which the workers live.

In pre-war days the demand for the flints they produced came chiefly from Spain and Italy, in the rural areas of which countries the old-fashioned flint-and-steel tinder-box has never been wholly supplanted by the modern match. But nowadays practically the entire supply is eagerly snapped up by the makers of those ingenious little mechanical devices for lighting pipes and cigarettes with which the war has rendered us familiar.

Rust Spots Turned Out to be Only Oil Stains

Peculiar Problem Came Up in Large Montreal Plant, Where Inspector Was Sure There Was Defect, While Superintendent Held His Shop's Work Was Well Done—Oil Was the Cause

ONE of the many causes of rejected shells has been the appearance of what the inspectors term "rust spots" on the walls of the bore. Inability to state definitely the causes of the formation of these spots has resulted in the holding up of finished shells until the objectionable feature has been removed, or until a district inspector has permitted the shells to pass. A notable instance of this was brought to the attention of the wrier some few weeks ago by the superintendent of a large munition plant manufacturing 6 inch high-explosive shells. After mastering ali the details in connection with the machining of the shell the work of production was proceeding with increasing regularity when the presence of these so-called "rust spots" was discovered by the inspector, and, despite all argument or contention on the part of the plant officials that the shells were almost perfect, the inspector insisted that shells showing such blotches could not be accepted.

Searching for the Trouble

Certain that these spots were not detrimental to the shell or its subsequent action, the superintendent determined to investigate and convince the inspector that such shells were as perfect in every particular as any others passing inspection. On closely examining several of the shells that had been turned down, it was invariably found that these objectionable blemishes were located about midway of the length of the shell bore. Further investigation showed that in few instances did these spots appear near the nose or at the base of the shell. Believing that rust spots would not be confined to any particular portion of the shell, the superintendent set to work to find out just what would cause these spots to appear. Carefully studying the various operations through which the shell passed it was thought that during the process of nosing was the most likely period in which the spots would be created.

Lubrication of Nosing Die

As is generally known it is the practice to swab the bottling die with oil to lubricate the surface to facilitate the operation and avoid undue wear upon the die. The use of oil also assists in the release of the shell after the nose has been formed, the sudden heating of the oil causing a gas to form in the shell, and the rapid expansion of this gas tends to eject the shell from the die.

Believing that here might be found the seat of the trouble, a close study was made of the possibilities resulting from the presence of this oil on the interior of the shell. As might be expected, when the workmen are lubricating the die, little attention is given to the amount of oil swabbed on, so that a splash is very likely to find its way into the open end and lodge on some section of the inner wall. In the heating of the shell prior to nosing, the open end is placed in a special furnace, and for a distance of approximately three inches is heated to a forging temperature. This high temperature is confined to the portion subjected to nosing, but the heat cannot be stopped at a definite line, and consequently the temperature gradually lessens towards the base of the shell.

Conclusions Arrived At

Accepting this as a basis of operations three distinct conditions were arrived at; first, the heat at the extreme nose was so great that a splash of oil on this portion would immediately burn off, leaving no trace of oil or carbon content; second, the portion near the base was comparatively cool, so that oil falling on this section would remain virtually in a normal state, being subsequently removed by the sand-blasting or washing process; third, the portion midway between the heated nose and the base would be of such a temperature that the liquid portion of the oil would be burned off but the heat not sufficient to consume the carbon content, this being deposited into the pores of the metal in such a manner that the spot affected would take on a different color to the surrounding metal, creating the condition that had given rise to the "rust spot" theory.

Attempts had been made to eliminate these spots by sand-blasting but little success could be accomplished, the only result being to produce a slight hollow at the affected spot.

Proving the Theory

To prove the conclusions arrived at from the study of the nosing operations, two shells were carefully selected that were practically identical in every particular, with the bores of both perfectly clean and smooth. The nosing die was cleaned and all trace of oil removed, the shells heated and bottled in the usual manner, without lubricating the die. One of these shells was afterwards placed in a furnace and the entire shell heated to a temperature corresponding to that generally attained midway of the length when the ordinary nosing process is performed. This shell was then swabbed with oil over the entire surface of the bore and allowed to cool. When cold these two test shells were cut in half, lengthwise, for close examination.

When these were closely inspected separately, one could not detect any difference between the walls of the shells, but when the four halves were placed together the contrast was quite striking, the surface in each case being quite clear and uniform, but the shell that had been treated with oil was of a slightly darker color than the other. One of the "rust spotted" shells was also cut in a similar manner and carefully examined in conjunction with the test shells, and the contrast between the rust spot or stain was exactly the same as that of the two shells treated for experiment. Little difficulty was experienced after this regarding the presence of these oil stains.

COMPRESSED AIR FOR CLEANING MOTORS

By Meredith.

In a great many manufacturing plants, especially those working in wood or a similar material, the driving motors have a tendency to become clogged with dust in a short time. Such accumulation of dust is a fire hazard, particularly if the motors are overloaded and liable to have coils burn out; and if a motor is not overloaded it may heat if the air ducts are filled with dust. Moreover, the motor is not able to carry the peaks when called upon, for the reason that the additional heat cannot be dissipated. Motors should be cleaned frequently, but such cleaning with the means ordinarily at hand is a rather difficult procedure since the air ducts are necessarily usually small and difficult to clear with a brush. The windows may be brushed off externally but such cleaning does not reach the real seat of the trouble.

One of the best methods is compressed air under considerable pressure. If the air is not available from some source already in use, it is advantageous to use a small motor driven compressor and a storage tank. The compressor should have a capacity of from 4 to 10 cubic feet of air per minute at a pressure of 100 pounds per square inch, and the tank should hold from 40 to 100 cubic feet. This size will take care of the average plant.

In piping a factory the air line can be in 1 in., ¾ in. and ½ in. pipe. Since the amount of air used in cleaning any one motor is small, a large pipe is not necessary. An outlet with a valve should be placed near each motor, or if they are grouped, several motors can be reached from one outlet with ½-inch or ⅜-inch hole. The smaller size is more easily handled. The nozzles can be made up of bras rod of suitable sizes and shapes, which, however, must have very small openings, as a large nozzle opening would consume too much air. Probably the most useful sizes would be 3/32 inch, 1/16 inch, and 3/64 inch, and these three nozzles will meet most conditions.

Sometimes it becomes desirable to clean surfaces with air; for instance, the walls or ceilings of the buildings. This may be done with a tool made from ⅜-inch or ½-inch pipe in which there are a number of holes, to form a "brush" of escaping air. For ordinary purposes holes of about 1/32 inch to 1/64 inch can be used.

These small nozzles do not clog readily if all the scale and dirt is blown out of the piping. As an investment such a cleaning system will be found to pay for itself in the reduction of motor troubles and the decrease in fire hazard.

OILS AND THEIR USES

By M. M.

EVERYONE knows something about the usefulness of oils in the workshop, but there are a great many who employ them indiscriminately, thereby making more or less serious mistakes. A little general understanding and commonsense is necessary, and also a little discernment as to the nature of the oils which are useful in everyday use. A very common mistake is to oil a sewing machine, bicycle, pram or clock with any kind of oil which happens to be handy. Frequently these are oiled too often and yet again they are oiled too seldom, being left till they squeak. Then they are given too much oil, often of the wrong sort, and then there is more trouble. The right oil to use for a clock, no matter what sort it is, is clock oil, which is a clean, thin lubricating oil that does not dry or get sticky. It is also suitable for any light machinery. The least possible touch of oil on the working parts only of clocks will suffice, and as the movements are slow, they do not need it often. Now if this oil were used for sewing machines and the like, they would require it too often, so a machine oil with more body is best used very lightly, but as frequently as may be needed to keep all the parts slightly greased. Fast-running machinery requires oiling the oftenest. Whereas once a year might do for a clock, once a day would be necessary for a machine in constant use. And the heavier the machinery the heavier the oil should be; engine oil is really heavy machine oil.

Linseed oil, in appearance, might seem to be a good lubricant; but it is altogether unsuitable. It dries like a hard varnish, and, of course, would clog any machinery almost as badly as varnish would, except that it hardens slowly. If a piece of rag that has been used in apers oil, and another wet with linseed oil, be left exposed to dry air for a considerable time, the former will be still the same, but the latter will have become stiff and heavy. For this reason it is quite unfit for using on hones and whetstones when sharpening tools, for it makes them hard and useless, but it is always around woodworking shops, and thus many workmen have spoilt their stones before finding the reason out. If used for oiling the bright blades of saws or other tools, it makes them brown and varnishy. But linseed oil is the very best for rubbing into the wood parts of tools to keep them clean, and it imparts a hard, finished surface. For woodworking and polishing it is invaluable; also, in the manufacture of varnishes, oilcloths and imitation leathers. Boiled linseed oil is the only kind for mixing paint; or it would never dry. It is also essential for making putty; the best is made from raw linseed oil and whiting. Very often cotton-seed oil is used as a substitute for linseed oil but is a very poor substitute. Linseed oil is useful for domestic purposes in reviving varnished furniture and leather goods. It is sometimes employed for machine belting, but castor oil is considered best for the purpose, also for the leather of bellows and such like articles, where suppleness and durability are required. As it is expensive, however, palm oil makes a good substitute.

Petroleum or paraffin, besides being the recognized burning oil for lighting and heating purposes, is excellent and cheap for cleaning the working parts of machinery before lubricating. It is good for thinning down machine oil before lubricating and makes a capital lubricant for locks and light machinery, if a little sperm oil is added. For sharpening tools on the whetstone, many workmen prefer it to any other.

THE INSPECTION DEPARTMENT

By M. R.

In the days before the war the engineering shop with an inspection department and a special staff charged with gauging and measuring each article produced, to see that it conformed to a minimum standard of accuracy, was regarded as a rather "advanced" concern. In the vast majority of general engineering shops the foreman kept a more or less vigilant eye on the work sent forward by his department, and the manager, personally or by proxy, inspected a finished job before despatch; but otherwise, the responsibility for seeing that faulty work was not turned out rested on the workman himself. He worked to a standard prescribed by his skill and self-respect, and the fear of bad work being found out and reported upon either by some other department or by the customer kept him up to the mark. But the war has changed all that. It has changed engineers into manufacturers of interchangeable parts, which stand to be rejected if they are not up to size within the plus and minus limits prescribed. In these circumstances it pays to set up a system of inspection whereby every patch of work is examined, for by so doing, faulty work can be discovered at once, and the man or machine promptly attended to. An instance of the saving effected by proper inspection is given by Mr. C. Turtle in an address to the Junior Institution of Engineers. A firm undertook a contract to supply half a million of a certain piece of ordnance mechanism, which involved something like 200 machine operations. For the first 100,000 the rejections were between 12 per cent. and 15 per cent. and it was soon realized that there was something seriously wrong. It was decided that the manufacturing side was all right, but that the inspection organization as it then existed, was not up to the new requirements. An inspection department and staff was therefore created, with the result that in the second contract for a further half million, the Government rejections dropped to 0.17 per cent. For the last 300,000 parts delivered under the contract the Government rejections only amounted to 0.034 per cent., which is believed to constitute a good record. That these exceedingly good figures were not obtained at any undue expense in material rejected at the works, was proved by the fact that the works scrap only amounted to 4 per cent. of the metal cut up. The improvement was obtained by prevennot only entailed an investigation of the gauges in use, but of them ethods by which they were handled and used, the machine operations and the personnel of the whole department. The practice of inspection, though vastly extended by the multiplication of war orders, will certainly not subside with the end of the war, for, quite apart from the execution of orders having size limit specification clauses, there are great economies in working to a proscribed degree of accuracy. Mr. F. W. Lanchester gave a good instance of this in his paper on worm gearing. Some years ago in designing certain mechanism Mr. Lanchester himself set every clearance dimension and tolerance dimension and these were worked to for a considerable time with satisfactory results. A new works manager, who did not believe in working to fine limits, reported that the limits were unduly fastidious, and that money could be saved by relaxing the limits and so avoid having to scrap part. The managing director consented, and the scheme was tried. A slight and questionable reduction resulted in the cost of manufacturing components, but the increased cost of assembling and testing, and the cost of rectifying complaints, etc., became so great that the initial saving was swallowed up many times over. Within twelve months the scheme was abandoned, and the old fine tolerances were restored, the expense of twice altering the gaugs, etc., being a dead loss, apart from the disastrous results of the experiment. It is but another instalment of the old story that what is gained by scamped work in the machine shop may be lost ten times over by extra work on the fitter's bench.

Hints on Steel.—Sanderson Bros. and Newbold Ltd., of Sheffield, England, have recently published a new issue of this instructive little 96 page booklet, covering all the essential details in connection with the working, hardening and tempering of their various grades of light speed and carbon steels. This booklet is very complete and will be found of great value to steel users. H. A. Drury Co. are the Canadian distributors.

Rapid Growth of Canadian Railway Club

At Present Time There is an Enrollment of 883 Members—Forty-five Members Are Now Overseas, and the Club Has Been Active in War Work at Home

THE Canadian Railway Club with headquarters in Montreal has made rapid progress during the past few years, both in the strength of the membership and the services the club has been able to render these members. The club has at the present time an enrollment of 883 members.

Over 45 members have enlisted for overseas' service, five of whom have since been killed in action, three wounded and returned. The retiring president, G. E. Smart, was untiring in his earnest enthusiasm throughout the year, and the success of the past season has been due very largely to his energetic leadership and that of his lieutenants. The papers and discussions of the sessional period were very instructive and educational in character, dealing particularly with subjects pertaining to problems created by existing abnormal conditions in connection with railroad work and organization; these papers were prepared by prominent railroad men in various branches of the service.

The inauguration of the Canadian Railway Club took place early in 1902. The advantages that would result from the formation of a society for the better education and co-ordination of its members was recognized by several local railroad officials who had previously experienced these benefits from similar institutions in the States. The preliminary meeting of the club was held on the 15th of February at the Queen's Hotel, Montreal. Prominent amongst those responsible for the initial movement were E. A. Williams, W. H. Rosevear, S. S. Underwood and M. P. Kelley. A general meeting was called for the 11th of March at the Windsor Hotel, at which the new Railway Club was organized and a committee appointed to draft out a constitution and the necessary by-laws. Twenty-six representative members were present at this meeting and the club started out with approximately 175 charter members. The first officers of the Canadian Railway Club were E. A. Williams, Supt. of Rolling Stock, C.P.R., president; T. A. McHattie, Master Mechanic, G.T.R., 1st vice-president; S. King, Master Car Builder, I.C.R., 2nd vice-president; M. P. Kelley, Chief Clerk Car Dept., C.P.R., secretary; S. S. Underwood, Draughtsman, G.T.R., treasurer. The executive committee were W. H. Rosevear, Jr.; Jas. Powell, T. H. Hopkirk, F. Sutherland and Acton Burrows.

Objects of the Club

The principal objects of the Canadian Railway Club are given in sections 1 and 2 of the constitution; first, the object of the club shall be the dissemination by means of reports, papers, investigations, and the discussion of knowledge concerning the construction, operation, and maintenance of railroads and railroad equipment, and the cultivation of sociability among its members. Second, no patentees or their agents or agents for the sale of railroad supplies, shall occupy the attention of any club meeting in the interests of the device in which they are personally or financially interested, unless they are especially invited to do so by a majority vote of the members present, or by consent of a majority of the executive committee, and the article they represent forms a part of the subject of discussion.

The Officers For 1918

The officers elected for the ensuing year were as follows: President, C. W. Van Buren, Gen. Master Car Builder, C.P.R., Montreal; 1st vice-president, T. C. Hudson, Master Mechanic, C.N.R., Joliette; 2nd vice-president, J. Hendry, Master Car Builder, G.T.R., Montreal; executive committee: W. H. Winterrowd, Chief Mechanic Engineer, C.P.R., Montreal; C. H. N. Connell, Division Engineer, C.N.R., Montreal; Arthur Crumpton, Asst. Valuation Engineer, G.T.R., Montreal; E. A. Nix, Asst. Works Mgr., C.P.R., Montreal; W. H. Sample, Supt. of Motive Power, G.T.R., Montreal; B. F. Shortley, Terminal Agent, I.C.R., Montreal.. Audit committee: D. R. Arnold, Sales Manager, Can. Car & Foundry Co., Montreal; Geo. Whiteley, Asst. Supt. of Motive Power, C.P.R., Montreal; G. M. Wilson, Master Mechanic, G.T.R., Montreal. Treasurer, E. E. Lloyd, Auditor of Disbursements, C.P.R., Montreal. Secretary, Jas. Powell, Chief Draughtsman, G.T.R., Montreal.

C. W. VAN BUREN, PRESIDENT

General Master Car Builder, Canadian Pacific Railway, Montreal

Starting his engineering career with the New York Central in 1889 being employed in the West Albany Car Shops. In July, 1905, he accepted a position with the Canadian Pacific Railway, as General Car Inspector. In 1906 he was appointed Divisional Car Foreman of the then Eastern division. He was appointed Master Car Builder of the Eastern lines, in the year 1909. He left the C.P.R. in 1911, to accept a position with the Union Stock Yards and Transit Co., of Chicago, Ill. Returned to the services of the Canadian Pacific in April, 1915, to the position of General Master Car Builder, with headquarters at Montreal.

GEO. E. SMART, PAST PRESIDENT

Master Car Builder, Canadian Government Railway, Moncton, N.B.

Started his mechanical career with the Grand Trunk Ry., in 1895, and in 1904 he left to accept a position as Supervisor of car heating and lighting with the Canadian Pacific Railway. He was appointed to the position of General Car Inspector in 1906. Three years later he was promoted to Divisional Car Foreman of the Eastern division. He resigned from the C.P.R. in October, 1913, to accept the position of Master Car Builder of the Canadian Government Railways, and has recently been promoted to Superintendent of the Car Department.

T. C. HUDSON, FIRST VICE-PRESIDENT

Master Mechanic, Canadian Northern Ry., Joliette, P.Q.

Born at Brockville, Ont., February 20, 1873; educated at Brockville and the Carleton High School. Started apprenticeship as machinist in January, 1887, with the Canadian Pacific Railway at Carleton Place. Served as a general machinist for the C.P.R. at Chapleau, Carleton Place and other points until 1901, when he was appointed Asst. Roundhouse Foreman for the C.P.R. at Smiths Falls, retaining this position until 1903. From then until January, 1906, he was foreman of general repair shops at Carleton Place, and for the next year was Locomotive Foreman for the C.P.R. at Ottawa. He resigned from the C.P.R. in January, 1907, to accept the position of Shop Foreman with the Canadian Northern at Parry Sound. In July, 1907, he was promoted to Master Mechanic of the Canadian Northern Quebec Railway, and the following year had the additional duties of the Quebec and L. St. John Railway. In August, 1915, he was appointed Master Mechanic of the C.N.R. system lines east of Ottawa, with jurisdiction extending over the Car Dept., this being his present position.

J. HENDRY, SECOND VICE-PRESIDENT

Master Car Builder, G.T.R., Montreal

Mr. Hendry has been employed as Master Car Builder of the Grand Trunk Railway, for the Eastern lines, with headquarters at Montreal since 1908. Previous to this he had served for a number of years with the Canadian Car and Foundry Company at Montreal, in charge of the passenger car construction department.

W. H. WINTERROWD, EXECUTIVE COMMITTEE

Chief Mechanical Engineer, C.P.R., Montreal

Born at Hope, Ind., on April 2, 1884, being educated at Shelbyville, Ind., and Purdue University, whence he graduated with the degree of B.S. in 1907. He entered railroad service in 1905, the first year as a blacksmith's helper for the Lake Erie and Western Ry. at Lima, Ohio; from 1906 to 1907 he was air brake and car repair man for the Western lines of the Pennsylvania Railway at Dennison, Ohio. The following year he served as special apprentice with the Lake Shore and Michigan Southern Railway at Elkhart, Ind. From 1908 to 1909 he occupied the position of roundhouse foreman for the Lake Erie, Alliance and Wheeling Railway at Alliance, Ohio, and the next year was transferred to Youngstown as night foreman of the roundhouse for the Lake Shore and Michigan Southern Railway; the next year serving as roundhouse foreman for the same road, at Cleveland, Ohio, and from 1910 to Sept., 1912, he acted as assistant to the Mechanical Engineer at Cleveland. He then accepted a position with the C.P.R. as Mechanical Engineer of the Angus shops at Montreal. In May, 1915, he was appointed assistant to the Chief Mechanical Engineer, and on April of this year was promoted to the position of Chief Mechanical Engineer.

CHAS. H. N. CONNELL, EXECUTIVE COM.

Division Engineer, Canadian Northern Railway, Montreal

Born in Woodstock, N.B., August 26, 1876, and received his early education in the Woodstock Grammar School. His railway career commenced in 1897 when he engaged as a rodman on construction and survey for the Crow's Nest Pass Railway (C.P.R.). The following year he was a topographer on survey of the Rainy River Railway (C.N.R.). He was appointed roadman on construction for the same company in 1899. In 1900 he accepted a position as roadman on construction and Assistant Resident Engineer with the Algoma Central and Hudson Bay Railway and was promoted to Resident Engineer of the same road in 1901, retaining this position until 1903, when he accepted a position as Assistant Resident Engineer with the Halifax and South Western Railway. From 1903 to 1906 he was engineer in charge of Surveys and Maintenance with the Alberta Railway and Irrigation Company of Lethbridge, Alta. For the next three years he held the position of Chief Engineer for the same company. In 1909 he was appointed Engineer of Maintenance of Way, on the Quebec division of the Canadian Northern Railway. In 1914 he was appointed Divisional Engineer, and last year was given the office of District Engineer with headquarters at Montreal.

EDWARD A. NIX, EXECUTIVE COMMITTEE

Assistant Works Manager, Canadian Pacific Railway, Montreal

Born at Columbus, Ga., August 23, 1872. Entered the service of the Central of Georgia Railway at Columbus, Georgia, at the age of 18, as apprentice car builder. After finishing term of apprenticeship worked for a time as journeyman car builder and was subsequently promoted to Freight Inspector, Passenger Inspector, foreman of car cleaners, and assistant foreman of the car shops. In June, 1897, he was transferred to Macon, Georgia, succeeding S. A. Charpiot, as Master Car Builder. In May, 1905, he was appointed manager of the Lenoir Car Works, Lenoir City, Tennessee. Here he remained until September, 1907, when he accepted a position with the Bodley Wagon Co., Memphis, Tenn., being appointed vice-president and general manager of the company. Re-entered railway service again in Sept., 1911, taking charge of the Car Dept. of the Illinois Central Harnham shops at New Orleans, La. He was transferred to Memphis, Tenn., in the same position, in February, 1913. Entered the services of the St. L. & S. F. Ry. at Memphis in May, 1915, in charge of the car department. In November of the same year he was again transferred to Kansas City, Mo., as Car Superintendent of the Northern Division. He accepted his present position as Asst. Works Manager of the Car Dept. of the C. P.R. at Montreal in April, 1916.

ARTHUR CRUMPTON, EXECUTIVE COM.

Assistant Valuation Engineer, G.T.R., Montreal

Is a native of Toronto and has been with the engineering department of the Grand Trunk for many years in responsible positions connected with the locating of new lines, as well as in the designing and superintending of construction of many important engineering works for the railroad and its subsidiary lines.

W. H. SAMPLE, EXECUTIVE COMMITTEE

Superintendent of Motive Power, G.T.R., Montreal

Was born at Altona, N.Y., August 20th, 1864, and entered railroad service on his birthday anniversary in the year 1882. For five years he was a fireman with the Central Vermont Ry. at St. Albans, Vermont. From 1887 to 1890 he was locomotive man with the Atcheson, Topeka and Santa Fe Ry. at Albuquerque, N.M. He returned to the Central Vermont as locomotive man and after one year was appointed to the position of Road Foreman of Locomotives, remaining in this position until 1906. He then resigned to accept a position as Superintendent of Motive Power and Car Dept. with the Northern Railway of Costa Rica (United Fruit Co.), San Jose, Costa Rica. He then came to Canada and on March 15th, 1911, he was appointed to the position of Master Mechanic for the Grand Trunk at Ottawa. From October, 1914, to October, 1916, he was Master Mechanic of the G. T. R. at Battle Creek, Mich. He was then transferred to Montreal as Master Mechanic of the Eastern lines, and in the spring of 1918 was appointed Superintendent of Motive Power with headquarters at Montreal.

B. F. SHORTLEY, EXECUTIVE COMMITTEE

Terminal Agent, Intercolonial Ry., Montreal.

Born in Montreal on June 24th, 1866. His railroad career commenced in 1887 when he engaged as a switchman with the Grand Trunk Ry,. being subsequently promoted to Operator and then to Train Despatcher. In May, 1900, he accepted a position as operator with the Canadian Government Railways, and was afterwards appointed to take charge of the Commissionary Department at Montreal. He was in charge of the stores department for a number of years and for the past five years has been the Terminal Agent at Montreal.

D. R. ARNOLD, AUDIT COMMITTEE.

Sales Manager, Can. Car & Foundry Co., Montreal.

Started his mechanical career in 1904 with the Barney and Smith Car Co., of Dayton, Ohio, in the mechanical department. He was transferred to the estimating department in 1910 and the following year was promoted to assistant to the President. On the first of March of the same year he accepted a position in the estimating department of the Canadian Car & Foundry Company of Montreal, and in 1914 was appointed Sales Manager for the company.

GEO. WHITELEY, AUDIT COMMITTEE

Asst. Supt. of Motive Power, Can. Pacific Ry., Montreal.

Born March 2nd, 1880, in the city of Toronto. Educated in the Toronto Public Schools, the Allandale Public School and the Barrie Collegiate Institute. Started his mechanical career as a call boy for the Grand Trunk Railway at Allandale in September, 1895. From March, 1896, until August, 1902, he served as wiper and fireman for the Canada Atlantic Railway. In Sept., 1902, he engaged as fireman with the C. P. R. operating out of Fort William. Transferred to Moose Jaw in January, 1903, and in March of the same year was promoted to engineer, located at Moose Jaw until Sept., 1909. He was then appointed Road Foreman of Engines, retaining this position until June, 1911, being then appointed to the position of District Master Mechanic with headquarters at Moose

Jaw. From January, 1913, to January, 1915, he was Master Mechanic at Calgary, following which he was appointed to his present position as Assistant Superintendent of Motive Power with headquarters at Montreal.

G. M. WILSON, AUDIT COMMITTEE

Master Mechanic, G. T. R., Montreal

He was born in Belfast, Ireland, on the 5th of October, 1867, of Irish and Scotch parents, and came to this country in 1880. After serving an apprenticeship to the machinist's trade he entered the service of the St. Clair Tunnel Company, in connection with the construction of the St. Clair tunnel, during the years 1889 and 1890, and afterwards was employed by the Jenks Shipbuilding Company at Port Huron, Michigan. After remaining with this firm for a brief period he entered the services of the Grand Trunk Ry. at Fort Gratiot, as a machinist, on the 11th of November, 1890, and subsequently filled the various positions of expert machinist, machine shop foreman, general foreman of the Toronto shops, general inspector of tests over the System, assistant Master Mechanic of the Montreal shops, and was appointed master mechanic on the 1st of Sept., 1917. In the year 1907 he was intrusted with the layingout and supervising the installation of the entire machinery equipment of the main shops of the Western Division at Battle Creek, and on the completion of this work he was transferred to Ottawa to supervise and install the power house equipment in connection with the new station and the Chateau Laurier.

E. E. LLOYD, TREASURER

Auditor of Disbursements, Canadian Pacific Ry., Montreal

Entered the services of the Canadian Pacific Railway as a clerk in the Stores Department at Winnipeg, on Dec. 27th, 1887. Was appointed chief clerk of the Stores Dept. at Vancouver, on Dec. 17th, 1897. Transferred to Montreal on Feb. 1st, 1903, and given the position of Chief Clerk and General Storekeeper. The two departments were subsequently divided and Mr. Lloyd remained with the accounting dept. as chief clerk. He was transferred to the auditing department of stores and mechanical accounts in January, 1905, Assistant Auditor on January 15th, 1910, and Auditor of Stores and Mechanical Accounts in August, 1913. He was appointed to his present position of Auditor of Disbursements on the 18th of March of this year.

JAS. POWELL, SECRETARY

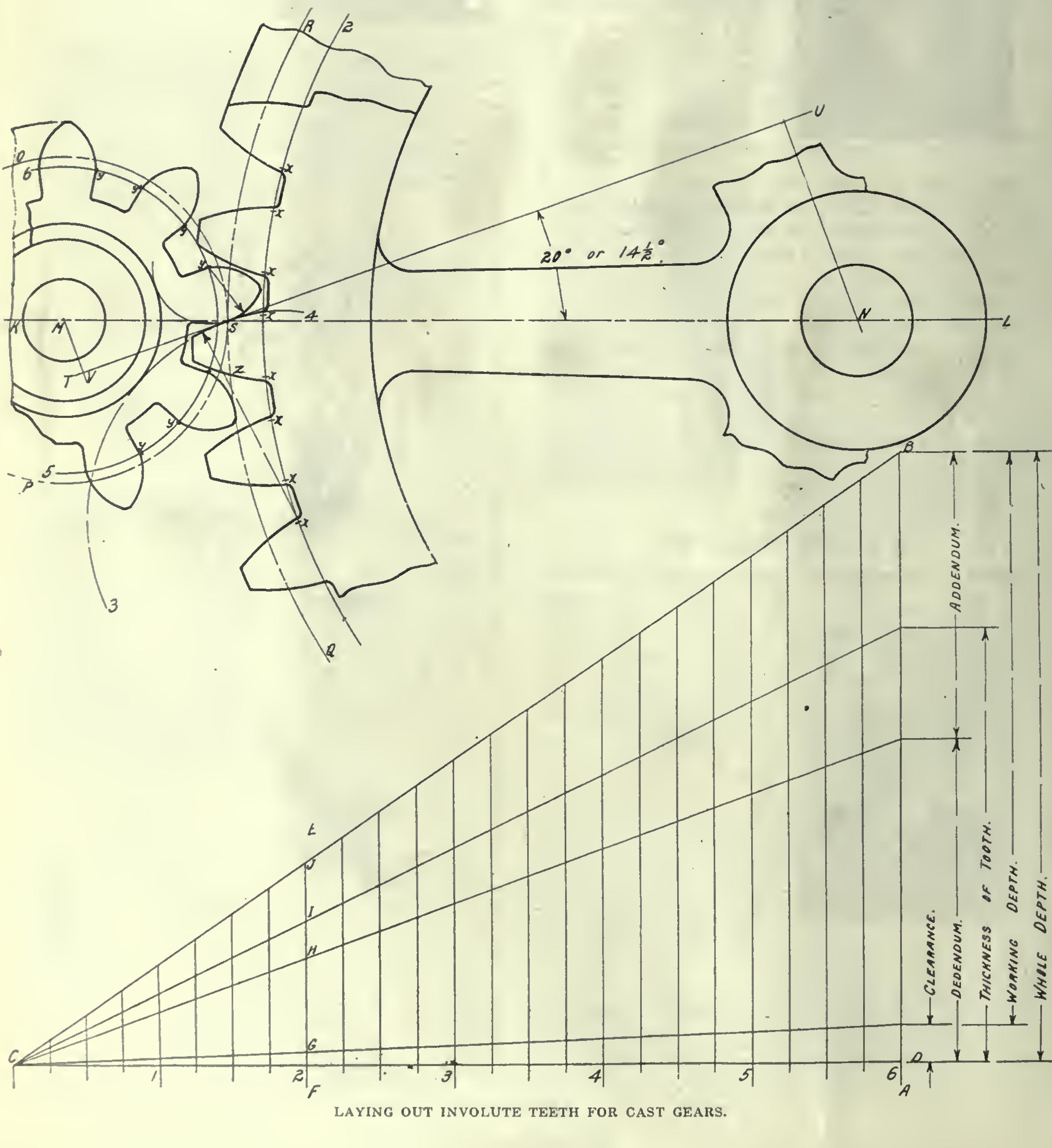
Chief Draughtsman, Motive Power Dept., Grand Trunk Railway, Montreal

Mr. Powell was born in England, serving his apprenticeship with Sharpe & Stewart Company, Ltd., locomotive builders, Manchester. He served in various capacities with different English firms, noteably the Naysmith Co., of Patricroft, Lancashire; the Vulcan Iron Foundry at Earlstown; and also the Lancashire and Yorkshire Railway, Manchester. He came to Canada about 1880 and for the past thirty-seven years has been with the Grand Trunk Railway occupying the positions of leading draughtsman and later as Chief Draughtsman of the company. Much credit is due him for the efficient training of the apprentices throughout the entire system. He has occupied the office of Secretary of the Canadian Railway Club for the past 13 years.

From "Belts," published by Federal Engineering Co.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity



LAYING OUT INVOLUTE TEETH FOR CAST GEARS.

SIMPLE CHART TO ELIMINATE FIGURING OUT CAST GEAR TEETH

The use of gears with cast teeth is common practice in many classes of machinery where absolute accuracy of operation is not essential, but to derive the maximum efficiency from a pair or train of cast gears it is necessary that the profile of the tooth should conform very closely to the desired shape to insure smooth and steady running. The accompanying chart was designed to facilitate the laying out of the teeth on the pattern, eliminating the necessity of calculating the various dimensions for the different sizes of gears and circular pitches. In order to make the chart of practical value the reproduction has been made to meet actual working requirements so that the dimensions can be taken directly off the chart and transferred to the work. However, it might be well to describe the construction of the chart so that those desiring to develop one for their own use can readily do so. It will be noticed that the principle is one of simple proportion, so that the same straight oblique line serves as a basis for the various dimensions of the teeth on different pitch gears.

The base line C-D can be drawn to any length but in this instance it has been given a length of 6 inches, so that the dimensions on the vertical line A-B, drawn perpendicular to the base line, from the 6-inch intersection, will be for a gear having teeth with 6-inch circular pitch. The clearance is generally taken as 1-16 of the working depth, the whole depth being approximately .6866 of the circular pitch. The thickness of the tooth, on the pitch circle in cast gears, is always narrower than the corresponding space. This difference will range from 3-64 inch in small pitches to 1-16 inch in the larger pitches.

An application of the use of the chart is shown above. The teeth on each gear would, of course, be laid out separately, but for sake of illustration they are shown here in mesh, the same principle applying in either gear or pinion. Two essential details are required before the tooth profile can be determined, namely, the length of the generating radius of the tooth face, and the position of the base circle from which the tooth shape is struck. To obtain these, proceed as follows: On the center line K-L lay off the centers M and N of the two gears, this distance being determined by the size and ratio of the gears. When the same has been found, strike off the pitch circles O-P and Q-R tangent to each other and intersecting the center line at the point S. Through this point draw the line T-V at an angle corresponding to the pressure angle desired, either 14½ or 20 degrees—the 14½ degree being the most common pressure angle, while the 20 degree method is sometimes adopted where gears are subjected to heavy duty and give a tooth with a thicker root and therefore a much stronger tooth—the latter being used in this particular instance. Through the centers M and N, and perpendicular to the pressure line T-V, draw the lines M-V and N-W.

We are now ready to lay off the teeth. Owing to the fact that the circular pitch is measured on the arc of the circumference of the pitch circle, it is desirable first to divide the pitch circle into the desired number of equal divisions to suit the number of teeth required. Then from each divisional point strike off the thickness of the teeth. From the center N, and with a radius equal to the distance S-W, describe the base circle 1-2. Now, with a radius equal to N-W, and from the points on the pitch line, giving the thickness of the teeth, as at S-Z, find the generating points, and with the radius N-W describe the arcs that form the faces of the teeth. A prolongation of one of these is shown at 3-4.

The same process is used for laying out the tooth shapes on the pinion, M-V being the length of the generating radius, V-S the radius of the base circle 5-6, the generating points being found as described for the large gear. In every case the arc of the tooth face is drawn from the outside circumference to the base circle, the remainder of the tooth profile being a radial line to the bottom of the working depth. A fillet, as large as conditions will permit, is then struck to form the connection between the flank and the root of the tooth space—usually equal to the clearance.

CUTTING THREADS ON SCREW MACHINES ON BAR STOCK AND CASTINGS

By P. W. BLAIR.

It is a well known saying among lathe-hands and machinists that "if you want a good and perfect thread it must be cut in a lathe."

It is true that a good lathe hand, if he is a first class man, can produce a fine thread on an engine lathe or screw cutting lathe with a special attachment, but it is an expensive operation grinding and setting a single pointed tool until it is at a correct angle and then finishing the piece until it is perfect.

The man next to him not as good a mechanic gets the same or more uniform results about three times as fast by roughing the thread down and sizing by running a die over the thread.

These methods giving good results are slow and expensive. The practical screw machine operator who has given the use of dies a careful study will be able to produce as good results when using a die to complete the thread entirely, if it is made correctly, at a fraction of the cost of lathe work on bar stock or castings. There may be other screw machine operators around him who may fail on the same work unless poor rough torn threads will pass inspection. In the past three years, owing to so many parts being made as component parts of shells, all of which have external or internal threads cut on some portion and the severe inspection and large quantities of above articles being made the cutting of threads has attained a high state of efficiency on screw machines and turret lathes that was unknown before the war.

An operator when given a good die should see that the two most essential things in setting up a screw machine or turret lathe are, first see that the dieholder or dies are in perfect alignment with the work, that the action of the turret slide is central or parallel with this alignment, also see that the die is square with the work, or to be more correct have the die parallel with the work.

It has been also demonstrated that the solid or shell type of dies will give more satisfactory results and threads cut to size better than by using the self-opening style of dies, owing to the slight taper which the latter cut on short lengths.

One of the best methods in testing out the alignment of a screw cutting die or hollow mill die in a screw cutting machine or turret lathe, to find out if it is central, is to give it the following test.

Run the die on to the piece until it fully engages on the threads then slip out the holder, is the easiest test for alignment.

However, if when the chuck revolves with the die on the end of the work it wobbles or runs eccentric something is radically wrong and imperfect threads will be cut.

If the operator is unable to get the die to run true a test arbor with a true thread should be cut in another machine, preferably a lathe. This is then gripped in a collet chuck and the die screwed on by hand; if the die then fails to run true it is a poor die which has been hobbed crooked, that is, when the hob entered the die it went in at an angle, or it sprung or warped in the hardening and tempering operation. By using a die in this condition the resultant thread will be tapered and in bad condition, and as the teeth in the opposite bands do not track, the thread wall will have a series of ridges and steps. Also, as the back edges instead of the cutting edges of the die lands are presented to the work the rubbing of same will tear the threads.

We all know that some new dies will not work satisfactorily at the start and the threads they cut will not pass inspection on munition parts and are quietly laid aside by the operator for fear he will use them. Others work fairly well and occasionally one is found so good that the operator hides it out and runs it to the limit of production.

A great amount of this irregularity and trouble can be traced to the poor alignment of machines.

One of the best methods I employ or pursue on a die when it is new and not giving perfect results is to take a true threaded arbor and open up the die sufficiently to permit it to run on freely then allow the die to close when it will grip the arbor securely enough for grinding. Then in a cylindrical grinder I grind the outside and back of the die true to the arbor and if the die was sprung in hardening I grind the face of the die parallel with the back. If the die and holder are not central with one another the holder is defective, or the hole in turret itself is out of line or otherwise defective.

The majority of screw machines have liners between the lower turret slide and the base for vertical adjustment. If one of these machines are out of line a machinist can readily adjust it or re-align it but the operator should not touch it unless he thoroughly understands what he is doing and has the proper testing tools.

Floating holders help out considerably when the error is slight, the only objection being that they are frequently the cause of dies starting on crookedly and cutting a thread that is not true with the body of the work. A floating holder that is really an advantage on a screw machine is the telescopic type, which permits the die to travel on its work independent of the turret feed freeing it from the drag of the slide, and allowing it freedom to travel on its work and follow its own lead.

These telescopic holders often save considerable time in setting up and will take up defects in some cases but will not of course correct alignment. Screw machines and turret lathes as they come from the manufacturers, generally have good alignment, but they wear and should be frequently tested and realigned by scraping or shimming. This is not only important for good thread work but for other operations also.

Usually if the machines are kept in as good condition as when received from the manufacturers there will be no trouble caused by poor alignment.

However, always test out new dies to see if they have to be fixed at the start and if care is used the threads will compare favourably with threads cut in a lathe.

THE VISCOSITY OF OIL

By M. E.

One of the most used methods of expressing the viscosity of oil is in the terms of the Engler Scale. Degrees Engler means simply the ratio of the time it takes a given quantity of an oil to flow through a standard orifice as compared with the time it would take the same volume of water to flow through. Oil is usually sold, however, on the basis of its specific gravity (generally measured in degrees Baume) and its heat value and moisture content. It is usually assumed that the heavier an oil is in degrees Baume the more viscous it is, but that is not always strictly true. It is not to be regretted, that oil is not specified in terms of specific gravity instead of in degrees Baume, because in any calculations involving the weight of the oil per gallon or per barrel, it is necessary to refer back to specific gravity. Further, the heaviest oil that can be designated on the Baume scale for liquids lighter than water is 10 deg. B. or unit specific gravity. Oils are now being used of 10 and 12 deg. B., and, no doubt, still heavier oils will be used, which will call for two different Baume scales and cause confusion.

LARGE BALL BEARING CONTRACT

The Canadian S K F Co., 47 King street West, Toronto, has received an order for S K F ball bearing hangers for the new shop being erected by the Leaside Munitions Company at Leaside, North Toronto. This contract will cover over 400 ball bearing hangers, and constitutes the largest order for hangers ever placed in Canada. It is significant in the development of anti-friction bearings that they are being universally adopted in the largest plants for all drives, and indications point to their even wider adoption in the future owing to their great saving in power and increase in range of application. Conservation of energy is one of the outstanding problems of the day, and the use of ball bearings is one method of attaining this end.

In a plant of the size such as will be established at Leaside, when a large amount of money is involved, the efficiency of ball bearings must be positively proved and demonstrated because it is possible to purchase similar equipment of plain ring-oiled bearings at considerably less cost. The savings in power and lubrication etc. are very high for ball bearing, and warrant this extra expenditure.

The S K F bearings have been installed in several of the larger Canadian plants, including the Canadian Westinghouse Co., Duncan Lithographing Co., and the T. Eaton Co., all of Hamilton. Also the Consumers Cordage Co., Montreal, the Howard Smith Paper Co., Willards Ltd., and the Laura Secord Candy Works, Toronto, all these being complete installations, in addition to many others.

REGULATIONS FOR DEALERS IN COAL

Regulations regarding the importation, sale and delivery of coal have been issued by the Fuel Controller. Among other things they require that every coal dealer shall post in a prominent place in his office a conspicuous typewritten or printed notice containing a list of prevailing retail prices of all classes and sizes of coal handled by him, including discounts, if any. In calculating overhead charges to determine the price of coal, dealers are required to exercise moderation in the amount they include as their own salaries. In this connection the regulations state, "Salaries and expenses to officers or partners are not to be increased over those prevailing during the year 1914 at a greater rate than salaries in other lines have increased. A dealer may charge his business with his own salary but a reasonable rate only."

Dealers conducting a retail as well as a wholesale business are required to apportion their overhead expenses and fixed charges to each branch, and this apportionment must bear reasonable comparison with the average overhead expenses and fixed charges of dealers who are engaged entirely in retail or entirely in a wholesale business.

A VAST NEW OIL SOURCE

The oil shortage brings into prominence a hitherto neglected source of oil in the form of "oil shale," an organic-matter bearing clay formation, which, when crushed and treated with super-heated steam, yields crude oil and sulphate of ammonia. The prospective development of the huge deposits of oil shale is one of the reasons for the oil land leasing bill now before Congress.

Shale occurs in widespread, thin beds which were formerly sea bottom. These beds are deposits of the clayey matter carried by rivers—clayey matter which, being finely broken up, does not sink readily to the bottom, but after being emptied into the ocean is carried by the current and spread over wide areas. One of the characteristic traits of shale formation is that it very readily breaks into thin layers.

Shale is oil yielding, but not oil bearing. Upon treatment with super-heated steam a chemical reaction takes place which yields crude oil. It must be mined like coal, and at about the same price, so that even with an extensive production of oil from shale there will be no great reduction in the price of oil.

Prof. Russell D. George, State geologist of Colorado, recently said that in two counties of Colorado there was enough shale to make "ten times as much oil as has been produced in the United States since the discovery of oil in 1859."

A new explosive is now being used in South African mines, and is resulting in a great saving of nitro-glycerine, says the "Board of Trade Journal." The shortage of the latter, owing to its use for ammunition, was indeed leading to difficulties in the industry. Hitherto the standard explosive used has been gelignite, which contains 57 per cent. of glycerine. It is now being almost entirely replaced by sengite, which is a gun-cotton explosive specially prepared and put into cartridges for the mines. The ingredients of sengite are more readily obtainable than nitroglycerine, and they are added to gun-cotton. Sengite is not altogether a new explosive but it is new to mining practice on the Rand.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

RESILIOMETER

THE comparative measurement of resilience has always been a matter of some difficulty and in the purchase of such materials as felt, rubber and leather this property becomes of some importance.

The Widney Resiliometer made by the Advance Felt Specialty Co., Chicago, eliminates guesswork in the purchase of such materials and enables them to be purchased according to a rigid specification.

In many cases, the use of the resiliometer will show that material used hitherto for a certain purpose was improperly selected and indicate the proper material to be substituted; or that the specifications of the same material should be radically changed. Felt frequently supplants rubber and leather, simply because it retains its resiliency or "life" longer than any other similar material.

Tone felt, as used in piano making, can be purchased with absolute certainty, according to pre-determined specifications based on tests, thus eliminating one of the greatest uncertainties in piano construction and leading to more scientific methods in tone production.

The use of resilient materials, such as mechanical felt, rubber and various kinds of packings, has greatly increased during the past few years, largely due to the enormous development of the automobile and other engineering industries. It is generally recogized that some definite and comprehensive means for testing the specific properties of such materials is absolutely essential to the intelligent purchase and use of them.

In the case of all resilient materials, and particularly of textiles, the properties and specifications to be ascertained are the exact dimensions, relative hardness, relative resiliency and texture.

The instrument consists primarily of a dial underneath which is a presser foot touching a perfectly level base or platform on which rests the material to be tested. Making sure that the quadrant which holds the weight descending from it is drawn up and held by the spring-catch, the operator lifts up the presser-foot and inserts the material which is to be gauged and tested.

The large dial is graduated in 100 divisions, each of 1-1000 in., so that one revolution of the large pointer or hand is equivalent to an elevation of 1-10 in. of travel by the presser-foot. When the material is more than 1-10 in. thick the needle will revolve more than once around the dial. To count these revolutions a small dial is shown inside the face of the large one, with a pointer or hand that makes one revolution to every four complete revolutions of the larger pointer or hand. This is for convenience in reading.

Suppose the material to be tested is 1-10 in. or .100 in. thick. As the presser-foot goes down the hand may stop at the 100th graduation. This means that the thicknesss is 100-1000 in., which is the thickness of the piece of felt accurately given by the "Widney Standard."

The spring-catch holding the weight is now released and allows quadrant to swing back until pressure is put on up-

RESILIOMETER

per end of presser-foot at the top of dial. At once presser-foot sinks into material, diminishing its thickness, sending the pointer or hand of the dial backwards. When the presser-foot reaches the limit of compression the reading on the dial at that time is taken and compared with the normal or original reading. For instance:

Normal thickness reading . .100 in.
Reading under pressure . . . .050 in.

This means that goods of a normal thickness of .100 in., showing under pressure a thickness of .050 in., are 50-100 or 50 per cent. hard.

If it had not compressed at all, its hardness would have been 100 per cent. (an impossibility with any resilient material). If it had compressed to one-fourth its original thickness, its hardness would have been 25 per cent. If it had compressed to one-tenth of its original thickness, it would have been 10 per cent. hard, and so on.

This gives us the hardness figure of the material in question—a figure henceforth fixed and certain so long as conditions remain the same.

As soon as the above reading has been taken the quadrant is pulled back, releasing weight pressure on the presser-foot. The hand on the dial will begin to advance again. When weight is raised a sufficient height so that weight pressure is released from the presser-foot, the reading of the dial hand is noted. This reading should be taken immediately the weight pressure is released, thereby ascertaining the "instant" resiliency and not gradual return to normal of the material.

Now suppose that the dial-hand (which was at 50 under pressure) advances as pressure is released till it reached .080 in. the resiliency is 60 per cent. For

$80 - 50 = 30$ and 30 is 3-5 of $50 = 60\%$

In other words, the hardness figures showed a compression of .050 in. If the goods reacted to their original thickness they would be 100 per cent. resilient. The amount of reaction in proportion to the compression is the percentage of their resiliency.

Resiliency is sometimes confused with elasticity or "stretchability." Elasticity, as commonly understood, is the capacity of a given material to react after distention or deflection, fairly illustrated by the reaction of a rubber band after being stretched or distended beyond its normal position; or the reaction of a steel bar after having been bent.

Resiliency is one of the most important factors in felt, rubber, and analogous materials, which are bought and used for cushions, bumpers or other mechanical parts. The resiliency of a material is logically and correctly determined by its capacity to recover from compression.

The thicker the material the greater the resistance to penetration.

SAFETY SWITCH

In many steel mills, factories, mines and similar industries where most of the workmen have little knowledge of electricity, it is desirable to use switches having no live parts exposed or accessible in the ordinary operation of the switches or when replacing fuses.

This is fully accomplished in the Krantz Auto-Lock Switch, marketed by the Westinghouse Electric & Manufacturing Company, which is intended for use on main circuits or wherever an ordinary knife switch is applied. The switching parts and fuses are enclosed in a steel box, the cover of which is in two parts, one being screwed on to form a permanent covering for that end of the box containing the switch, and the other part being hinged so as to swing back and permit the renewal of fuses, which are located in this portion of the box. An ingenious latching mechanism makes it impossible to open the cover without first throwing the switch to the "off" position and rendering all fuses and other accessible parts dead. Thus fuses may be replaced at any time with absolute safety. As long as the door of the case is open the switch contacts can not be closed.

By using a padlock, the switch handle can be locked in the "off" position, making it impossible for any one to close the switch except the person holding the key to the padlock. By using another padlock the cover may be locked shut, so that the fuses cannot be tampered with. Either of these padlocks can be used independently of the other so that the switch cover can be locked shut with the switch either "on" or "off", or the switch can be locked in the "off" position with the cover either locked or open.

Contact is made by means of a laminated spring copper brush, double ended, with auxiliary arcing contacts at each end. The outer leaves of the brush are bronze to provide additional spring pressure.

The stationary contacts are of hand-drawn copper and are mounted on slate bases, one of which in the fused switch carries one of the fuse clips, while the other forms the terminal block for the incoming line and is mounted under the stationary portion of the cover.

The operating mechanism is galvanized steel of the toggle type, and is attached to the under side of the stationary end of the cover. This mechanism can be easily removed for inspection by removing several screws.

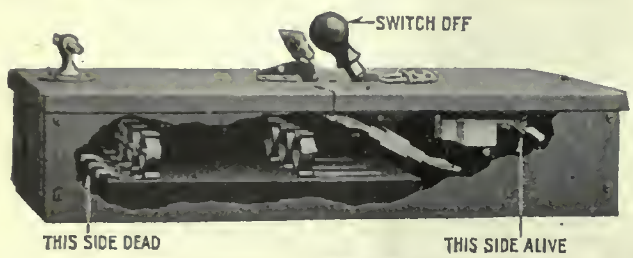
In closing, the pressure between the contacts causes the laminations of the brush to spread apart, giving it a wiping or self-cleaning action.

The double-ended brushes provide a double break, dividing the arc between the two ends, each of which is provided with a separate arcing tip.

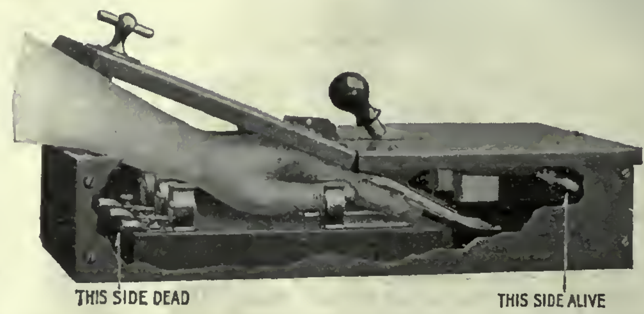
In the closed position the switch is held in positive contact by throwing a toggle over the center. A spring provides a quick-break for opening, the mechanism being independent of the operating handle.

These switches are supplied for 250 500 and 600 volt, for either alternating or direct-current, service, and in capacities up to 2,000 amperes.

The safety features of this switch have been recognized by the American Museum of Safety, which has awarded it a gold medal and special mention.



SAFETY SWITCH BOX CLOSED, SWITCH OPEN.

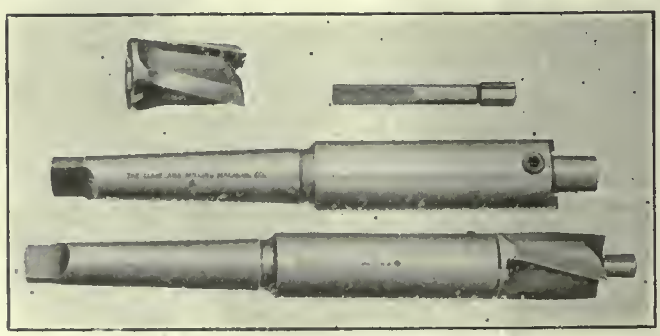


SWITCH. SHOWING IMPOSSIBILITY OF TOUCHING LIVE PARTS.

INTERCHANGEABLE COUNTERBORES OR SPOT FACERS

Counterbores or spot facers are more commonly used at present than heretofore and practically all machine shops use counterbores or spot facers of some description. With this in view the Cleveland Milling Machine Co. have brought out a line of counterbores illustrated in the accompanying engraving.

The shank is made of high carbon steel and is heat treated. The taper is ground concentric with both the driving taper and the pilot hole. The cutter is made of high-speed steel and has a taper hole fitting the arbor and is driven by two face keys so that cutters of various diameters can be used. This construction of cutter makes it possible to easily grind the face of the counterbore true. The pilot is made of high carbon steel, heat treated and ground to fit the hole in the shank and cutter, and it is arranged so that any diameter pilot can be used with any diameter cutter within its range and the change made very quickly. The diameter of the pilot is ground .0015 smaller than the specified size.



INTERCHANGEABLE COUNTERBORE OR SPOT FACER.

FILING MACHINES

The filing machine illustrated herewith has been designed for efficiency, rigidity, and simplicity in construction and operation. A feature of this machine, made by the Newark Engineering and Refrigerating Co., Newark, N. J., is the square shaft which is supported by two extra long babbit bearings making side motion impossible, thereby eliminating the tendency to under cut when working to finished lines. An extra large working platen enables the machine to handle a great variety of work and adjusting and locking screws provide for adjustment of the angle at which the platen is set.

FILING MACHINE

COTTON CLOTH FOR AIRCRAFT

By M. M.

The cotton trade presents many war features. One of the most interesting —and one that is often overlooked—is the provision of cloth for use in the building of aircraft, more particularly of aeroplanes. In this direction the trade has afforded most valuable help to the Allies. In pre-war days the making of aeroplanes fabrics had secured a solid footing in Lancashire, and the government exercised a wise discretion, soon after hostilities began, in acquiring control of the whole output and preventing leakage to the enemy. But prewar production was far from sufficient to meet war needs, and in the last two years there has been a considerable development in the making of fabrics that aeroplane building has asked for. More spindles and more looms have been set to work. Some of the best known and the biggest of the fine spinning concerns are wholly devoted to turning out the yarns, which are spun from high-grade Egyptian and from Sea Island cotton. To make this supply of cotton certain was one of the subjects which the government had in view in deciding to take over the whole of the next crop of Egyptian cotton, a step which had received unanimous approval of the trade.

In application of fine and strong textile to the covering of aeroplane wings cotton has been running a sort of race with linen. There is no doubt that the use of linen, in the past at any rate, has presented some advantages over the use of cotton cloth. Linen is stronger, and has a smoother surface. On the other hand it is heavier, usually weighing 4 oz. per yard as against 3¼ oz. in the case of cotton, an important consideration. One objection to cotton has been that the surface being less smooth than that of linen, there is some interference with the proper application of dope. As to the comparative strength of the two fabrics, one would suppose that cotton cloth, which will stand a strain of 1½ tons per square yard, would meet all demands that are ever likely to be made upon it. However there is no finality in sight in the design and manufacture of cotton fabrics. No one feels more strongly than manufacturers that we have not yet sounded the possibilities of cloth. The more the staple is examined and tested scientifically, the more wonderful does it appear, and the more clearly is it recognized, that the end is not yet. So far, the twin sciences of spinning and weaving in practice have kept fairly level with the demands of the public, but further progress will be made, and it is not too much to hope that cotton cloth will be produced which for aircraft purposes will be of unapproachable excellence and suitability.

At the present time experiments are being carried out with the object of eliminating faults and defects, such as they are, and of providing, a fabric which shall fully satisfy the needs of the aircraft industry. Designers of aeroplanes have laid down certain requirements and the cotton trade is endeavouring to meet them. It must be remarked in this connection that, as the aircraft industry has grown, its needs in the way of essential materials have grown with it and have become more exacting. The chief objects now aimed at are still greater strength and durability, and still greater powers of resistance to wind pressure, with an absolutely smooth and even surface that will not be too absorbent of dope. All this has to be accomplished without any sacrifice of lightness, and without any considerable reduction in the element of elasticity. We have every confidence that the response of the cotton trade will be of the most satisfactory character, and that the aeroplane cotton fabrics of the future will be worthy of a great industry which in the past has scored many triumphs.

MACHINE SHOP HEATING AND VENTILATING

By "Dale"

Considerable difficulty is experienced in arranging for the heating and ventilating of the single storey sheds with saw-tooth roofs now in universal favor for light machine shops. The wide expanse of surface exposed to the weather in such buildings makes the task of maintaining a comfortable working temperature difficult on cold days, and while roof ventilators and fans afford adequate ventilation in summer, they are invariably put out of action in winter on account of the excessive down draught of cold air, whereupon the air in the centre of the shops becomes stagnant and impure. But satisfactory hygienic conditions are essential to the maintenance of efficiency; hence some method must be devised to supply warm, fresh air in the winter, and cool air in the summer to all parts of the building. A good arrangement has been in work for two years past in a well known English plant at Birmingham. It consists of a number of cupola-shaped heaters (four in this particular case) distributed about the shed, each of which draws air by means of a 15-inch motor-driven horizontal propeller fan, located at the b- down inlet pipe protruding through the roof, passes it through a battery of steam pipes, and ejects it at the floor level, whence it rises and circulates through the building. The down pipe is fitted, just below the roof, with a swinging damper which can be moved so as to block the admission of outside air and allow the warm air from inside the shop to be passed and repassed through the heater. This is very beneficial on cold mornings, as it enables the air to be raised to a suitable temperature in a short time, whereupon the damper can be moved back and the temperature maintained with the cold air outside passing through. This feature is a distinct improvement on many other types of heating apparatus. The steam is supplied to the heaters from a vertical boiler 9 ft. high by 3 ft. 9 in. diameter (which if worked at 80 lb. per sq. inch, is capable of serving eight heaters in the coldest weather) through 1 in. branches from the main steam pipe, and is trapped at the outlet with a steam trap of the float type, in order to prevent the passage of uncondensed steam. The condensed steam, after leaving the trap, is forced along a ¾ in. pipe, past a check valve, into the main return pipe, which conveys it to the boiler feed.

The legs of the heater are utilized as a means of connection to the stem and drain pipes. Valves are fitted to both pipes of each heater, so that one can be out for repairs without disturbing the others. The temperature can be varied by altering the steam pressure, by varying the quantity of steam passing through the steam valves, or by means of the motor regulator, the latter being arraned to give four different speeds. During the warmer weather, when it becomes unnecessary to use the heating part of the apparatus, the fans are used for ventilating only. The impure air escapes through the interstices in the doors and between the valley gutters and the lower purlin on the glazed side of the roof. By reason of the pressure inside the building being slightly greater than that of the atmosphere, all leakages are from the inside outwards, and hence draughts are prevented. The cost of this method of heating and ventilating compares very favorably with any proprietary system, and at the same time meets all the requirements of a modern heating and ventilating plant.

It has been found possible mechanically to work tungsten containing a considerable amount of tungsten carbide when the carbide was made separately, powdered, and added to the tungsten powder before pressing. Tungsten ingots containing tungsten carbide made up in this manner may be mechanically worked when the carbon content is far in excess of that necessary to make the tungsten brittle ordinarily. When added in this way the tungsten carbide does not surround the tungsten grains.

In response to requests from the Ministry of Munitions and the Department of Scientific and Industrial Research, and in conjunction with the British Chemical Ware Manufacturers' Association and the British Laboratory Ware Association, arrangements have been made, with the aid of the Ministry of Munitions, for testing graduated glassware at the National Physical Laboratory on a larger scale than has hitherto been possible. The conditions of test, and scale of charges, are given in the test pamphlet of the Metrology (Glass Testing) Department, copies of which may be obtained on application to the Director, National Physical Laboratory, Teddington.

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The Position of the Scrap Metal Trade

ONE of the changes that has come over at least one line of business as a result of war conditions has been the lifting of the scrap metal business out of the ordinary class, and placing it in the very extraordinary division.

Our first impression of the scrap business may have been gathered from the time when we used to spend Saturday afternoons out looking for old metal and bones, for which there was always a few cents recompense in any town or city in the country.

Very few outside of the trade know the tremendous amounts that are involved in the scrap transactions that are going on at present. And were it not for the fact that the Munitions Board steps in and takes over all the turnings and cuttings from the munitions shops now, there would be a volume of business in this line that would be hard to credit or believe.

The little old rickety wagon that wabbles around picking up the scrap iron is certainly coming into its own with a vengeance. It may be that in the near future we will see traffic cops giving it right of way over every other sort of vehicle in the congested area, and the gentry in charge of them wearing medals that will make iron crosses look flat, tame and uninteresting.

A decision that was made last week in a case that came up in one of the big steel and iron centres of the United States has a greater bearing than the simple giving of the decision. It was, in effect, that those working in scrap yards, sorting and handling second-hand metals, were engaged in useful occupations. There were a lot of people who had a habit of looking down on the man working in a scrap yard as following a poor game. There may have been nothing very romantic about the occupation, and it may have been from sheer necessity that the man entered the occupation. Well, allow for all that, but look at the standing of the business now. When other lines, that in ordinary times are apt to try for a top rail on the fence, and plume themselves as being very legitimate and useful businesses, are being closed down by the War Board as non-essential, the sanction of the same board is given to the men working in the scrap metal yards. Quite a change, isn't it?

The war is cutting a lot of new swaths that are hurting the feelings of not a few people. No man likes to have his organization dubbed by the authorities as non-essential. He has been in the habit of imagining that his little undertaking was the most essential concern in the country, and that if anything happened to it, panic, widespread an dterrific, would certainly come and camp in our midst.

But his concern has been passed by. The authorities have put the thing in the sieve of war need and it has gone through the meshes. The man at the head of it has been told that he can't enter the market for iron or steel, and he will have to close up until after the war or do something more necessary in his shop. There is bound to be a great old trail of punctured pride, hurt feelings and ruffled dignity in the land while a batch of these non-essentials sit down at the side of the road and watch the scrap metal cart go by in the procession approved by the Government.

Real Economy in Burning All the Coal

THERE seems to be no end of advice given officially and otherwise to the Canadian public this year in regard to the necessity of saving coal, both in power plants and in the heating plants for the home. Occasionally there are some suggestions in regard to the proper methods of firing, and the securing of perfect combustion that have some real value, but there is a great deal of wasted and misspent effort in the advice given as a general thing.

Real results are going to be secured in making it certain that the greatest possible amount of heat is secured from the fuel we burn.

A steam engine is a waster at best. It is considered quite satisfactory to use 20 per cent. of the actual steam value delivered to the ordinary engine, and in many cases the figure will be well below that.

Boiler efficiency is another matter that has much to do with the amount of coal burned and the relative amount of heat obtained from it. There are, of course, boiler plants where as high as 80 per cent. of the heat in the coal will be secured, but that is above the average. Perhaps a figure around 60 per cent. would be much nearer.

There should be an effort made to induce power plant users to go ahead and introduce in their premises appliances that will make it certain that they will secure the maximum amount of heat from every ton of coal that goes into their furnaces.

Very little is going to be gained by simply keeping up a harangue that the people should burn less coal. That will probably result in decreased efficiency all round.

The big drive should be to see to it that we burn coal instead of letting a large percentage of the combustible material drift up and out of the smokestack.

AN extraordinary story of a boy's enterprise was related at London Sessions, when Robert Scott (17), engineer, pleaded guilty to receiving stolen tools. Mr. St. John Hutchinson said accused was undoubtedly a lad of exceptional ability with a future before him. He left the Hugh Myddelton School when fourteen years of age, and entered prosecutor's employ, showing such engineering skill that at fifteen he was earning 35s. a week. While still that age he and another boy took a back room and commenced making screws and nuts. The partner, reaching eighteen, had to join the army, but Scott continued working, and was so successful that he was able to take premises at £130 a year and employ eleven men and eight women. He had saved £400 and spent it on machinery, and a further sum saved had been invested in war stock. He now held large contracts with the Government relating to aeroplane work. Sir R. Wallace, K.C., said that all must regret that the lad had used his marvellous gifts in such a way. He would give him another chance and bind him over to come up for judgment if called upon.—Birmingham Post.

* * *

AMERICAN officers in Canada are well pleased with the way Canadians are handling their orders. They started out to make this place the granary of the Empire, but they simply can't keep from sticking a machine shop in between the farms.

SPECIALIST IN FINE SCIENTIFIC TOOLS

From His Early Youth, Robert Dawson has Been Associated With the Manufacture of Accurate Recording Instruments

CHANCE, as a factor of industrial achievements, is rapidly being eliminated from the field of engineering, as the manufacture of fine scientific and mechanical instruments of the most modern type now assures a degree of accuracy never attained in the past. Until very recently work of this character had received little attention here in Canada, but early in the present year

ROBERT DAWSON

the engineering firm of Peacock Bros., Montreal, decided to open a new department for the repair and maintenance of the many recording instruments passing through their hands.

One of the essential considerations in connection with the efficient operation of such a department was that of securing a man suitably adapted, and with the necessary knowledge of such instruments, to carry on the work successfully. The firm, however, were fortunate in acquiring a man whose life has virtually been spent on a class of work that specially fits him for this previously neglected branch of Canadian industry.

Robert Dawson was born at Edinburgh, Scotland, of Scotch parents, but when two years old was brought to Canada, where his father secured a position with Messrs. Ross of Montreal, who in the past seventies were engaged in the manufacture of all classes of civil engineering instruments. When young Dawson was about seven years old the family returned to Scotland but shortly after migrated to Dublin, Ireland, where the father secured employment with the instrument firm of Yeates & Son. Subsequently, however, the senior Dawson started in business for himself, so that the early years of the "boy's" life were associated with the work that he eventually mastered. Much of his early training was acquired at the Dublin Technical School where the education proved of great assistance in his practical efforts.

After putting in several years of "spare time" with his father, Bob entered the services of Yeates & Son and gained a wider experience in the manufacture of all kinds of scientific instruments. After several years with this firm he engaged with Dobson & Curtis, remaining with them until they went out of business, afterwards entering the employ of Sir Howard Grubb at his astronomical works, Rathmines, Dublin. Sir Howard Grubb is famous all over the world as a manufacturer of large telescopes and other observatory equipment, and under his guidance Mr. Dawson helped to build instruments for Australia and South Africa.

Gains Further Experience

His next position was with the firm of Thos. Mason, Dane St., Dublin, where he had charge of the laboratory for testing and adjusting all kinds of measuring instruments, atmospheric recorders and all kinds of civil engineering instruments. While associated with this firm his work kept him in close touch with many of the large colleges of Ireland, notably Trinity College, the College of Science, all the colleges of Dublin, and many others throughout the country. In this position he also became expert in the moving picture business, Messrs. Mason having the largest connection in Ireland in the optical lantern moving picture machine trade. After acquiring considerable experience with this firm, Mr. Dawson opened a moving picture theatre of his own, but gave it up after a short period and came to Canada in 1913.

He Comes to Canada

His first position here was with the Gowland Optical Co., of Westmount, where for nearly five years he was engaged on fine machine work almost continually, the company manufacturing tools which were extremely accurate for grinding and polishing optical lenses. Upon learning that Peacock Bros., of Montreal, were contemplating the opening of a new department for the repairing of all kinds of scientific and recording instruments, Mr. Dawson made himself known to the firm and his past experience and general qualifications were such that he was engaged "on the spot" to take charge of the new department.

Prior to January of this year it was practically impossible to have repairs of this description made in Canada so that it was necessary to send the instruments to the States for overhauling and repairs, entailing not only an additional expenditure of money but long delay in getting equipment returned.

In addition to their regular engineering lines the impetus given to marine development has increased the scope of Peacock Bros.' activities and Mr. Dawson's duties have required his presence on many of the vessels plying in and out of the port of Montreal, for the purpose of repairing and adjusting many of the recording instruments used for navigation.

Mr. Dawson in his department specializes in the "Foxboro" type of recording instruments, he having made an extended visit to the works at Foxboro, Mass., to acquire the essential knowledge required for efficient service. Many other types of equipment reach him for repairs and are promptly turned out in working condition.

Mr. Dawson in commenting on the value of technical newspapers, says, "These papers are of vital importance to anyone working at a trade, as they enable one to keep in close touch with all the most recent developments and improvements in machines and equipment."

We never knew very many people who got into much trouble minding their own business.

* * *

IT'S an awful sensation for a man to go away for a couple of week's holidays and then come back and find that business has gone along splendidly during his absence.

* * *

SOME of the women who have been working in machine shops for the last couple of years, will, when they return to domestic life, be persisting in pouring oil on the bearings of the egg-beater, and adjusting to fine degrees the mechanism of the coffee grinder.

MARKET DEVELOPMENTS

Much Harder to go Into the U.S. Steel Market

Production of Steel is Gratifying, but it Cannot Keep Pace With the Demand For Plate—Scrap Dealers Classed as Being in the "Useful Occupation" Class by United States Courts

A finding recently handed down by one of the courts in Pittsburg gives an interesting sidelight on the tendency of war decisions, and the out-of-the-ordinary things that happen when they get down to deciding between essentials and non-essentials. The scrap metal industry is little understood in many centres. The scrap cart is not looked upon as having a very pronounced standing in the commercial category. But the U. S. courts have ruled that men employed in scrap yards are working at "useful occupations," and are given such recognition by the war authorities. And this is happening right at a time when a large number of industries that in peace time imagined they were very essential are being denied access to the steel and iron markets.

Some of the more recently placed contracts in Canada are getting well under way and production will be secured in a short time. The American officials in Canada are well pleased at the way in which the work is going on here, one of them being authority for the statement that the reports from this district reaching Washington were second to none in any part of the continent.

It is becoming harder to secure steel in any shape from the American mills. There is a tremendous demand there for plate for the Emergency Fleet, and the figures advanced seem to increase every time there is a fresh announcement made of the requirements of the situation. Nor does it seem to make much difference who is the seeking party in Canada. For instance the firm contracting for the boilers to heat the Parliament Buildings at Ottawa have been held up for a good many weeks on account of their inability to secure boiler plate. An attempt is now being made by a Cabinet Minister to have this plate included in the Canadian allotment for the month and released immediately.

There is still a large volume of business being done in machine tools and supplies. Some of the firms here are having a little difficulty in tooling up for new contracts, not being able to get deliveries on all the material they require. The demand for high speed steel is very active again, and some lines are not securing as rapid deliveries as might be desired.

Production figures from the large producing centres in United States show that figures have kept up remarkably well during the hot weather. There is always a falling off during the excessively hot period, but this tendency has been less marked this year than formerly. No doubt the urgency of the situation has had much to do with the way in which the men in furnace and rolling work have kept production up to a high standard.

Many of the mills report a good supply of heavy melting steel in the yards and on the way. In fact, some of them are so well supplied just now that they are not taking on further supplies. There is still a scarcity of good machinery scrap, and some of this would be very acceptable in a good many foundries just now.

EXTREME HEAT OF WEEK AFFECTS OPERATION AND PRODUCTION

Special to CANADIAN MACHINERY.

MONTREAL, Que., Aug. 13.—Activities in almost every industry have been more or less affected by the exceptional hot wave that has been prolonged during the past week. Production in many lines has fallen off and in some instances sections of plants have been been forced to operate on shorter time to relieve the men from the extreme heat. Another feature that has a bearing on the general conditions is the holiday season that invariably affects business. Inability to secure materials has tended to disorganize business, but under the circumstances operations are proceeding with reasonable regularity.

Steel Still Acute

Tension in the steel situation is still very pronounced and no relief has been shown in the obtaining of material from the mills. Nothing but oessential requirements will receive cnsideration from the War Trade Board and therefore domestic trading has been virtually eliminated. Manufacturers here are still seriously handicapped for lack of sufficient steel for capacity operations, and this condition is more pronounced in the shipbuilding industry than in any other, plates being the material that is the hardest to obtain. As may be expected the extreme warm weather has been and will continue to be a detrimental factor to production, as workmen are frequently unable to keep the pace that is possible in cooler weather. The situation here maintains its acute condition, and dealers do not anticipate an early change for the better. With few exceptions the market is held very firm and prices are unchanged.

Good Demand for High Speed Steel

As a result of the recent activity in the manufacture of munitions the requirements for high speed steel have been on a scale equal almost to that of a couple of years ago. Difficulty is still experienced by dealers here in obtaining supplies of steel from the makers, especially where the source of supply is in England. One dealer reports that delivery from Sheffield cannot be assure under a period of from 6 to 9 months. Sizes that are in heavy demand can virtually be disposed of on the very day of their arrival. Consumers show some reluctance to purchasing sizes larger than they need, as in many instances the surplus must be wasted, and at $2.25 per lb. this is very often a serious factor.

Metals Generally Quiet.

Apart from the nervousness that still prevails in the tin situation the metal market has developed no features of special interest. Copper has steadied following the assurance that the existing price will prevail until November the 1st. Tin attained a record high during the past week, but is again at the level of the past several weeks. The other metals are comparatively quiet and price quotations are unchanged.

COPPER—The situation has taken on a steadier tendency owing to the announcement that the newly revised price will be extended to Novmber the 1st. Metal is still hard to obtain owing to the abnormal requirements both here and in the States. Prices here are very firm at 31 and 32 cents per lb.

TIN—The market is still in a very acute stage, this having been additionally emphasized by the recent advance to uprecedented price on the Singapore market. This peak quotation, however, has since declined and the situation is again back to its previous position of uncertainty and nervousness.

Dealers here are still having difficulty in securing metal, but are able to supply the most essential needs of their customers. Local quotations are very strong at $1.25 per lb.

Holiday Season Affects Tool Business

In common with all general business the machine tool activity has been passing through a quiet period as a result of the warm weather and the absence of the officials responsible for the placing of orders for tools and equipment. The decline in the enquiry for new machinery for shell making would appear to indicate that the bulk of the tools required for this purpose have already bbeen ordered. Many of these tools, however, are still waiting to be delivered but the pressure on the machine bulider is at present so great that definite date of shipment is very uncertain. This condition is not conducive to maximum steel production and where used equipment can be found available the same is often temporarily acquired to assist production. The general demand for machine shop supplies continues very good but frequently the same condition of uncertain delivery applies to this as to the heavier tools.

Scrap Very Quiet.

The scrap situation has been somewhat affected by the warm weather and the holiday season and general trade is very quiet. Dealers report little doing, the bulk of the business being of a local character, small lots of odd material coming in from the country. The present demand is far from encouraging, but dealers here anticipate a renewal of activity within a few weeks. Dealers here are rather reluctant to stock up when the demand is so light as consumers are only buying to cover their immediate requirements. A few changes have taken place in the week's quotations, notably in copper and brass. Copper is now ranging from 21 cents for light to $25.50 for crucible and heavy. Light brass is now quoted at 10 cents, being a little easier than last week. An advance of $2 on stove plate puts the current price at $26.00 per ton.

POINTS IN WEEK'S MARKETING NOTES

Inability to get boiler plates from U. S. points has held up boiler work for the Ottawa Parliament Buildings. One of the Dominion Ministers is trying to get the amount included in the Canadian allotment.

—

The price of plate is practically fixed at $10 for Canadian points. Before the war sales were made at $2.50, and dealers claim they made more money at that sale price.

—

Canadian authorities now recognize $7.50 f.o.b. mill as the selling price for steel plate.

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A finding in U. S. courts places workers in scrap yards in the category of those who are following a useful occupation.

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Machinery scrap is much in demand, but reports have it that some of the mills are well filled up with heavy melting steel—so much so that no new purchases are being made.

—

American officials attached to the Imperial Munitions Board here are well pleased with the production records they are securing here.

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U. S. experts are not certain whether it would be good policy on their part to try to build new blast and open hearth furnaces. At present all war activity practically rests on the ingot production.

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The shipments of Lake Superior iron ore that are passing down this year are breaking by a large margin all previous records.

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Reports for the past few months show that United States railroads are getting a much higher car-mile rate than formerly.

—

Pittsburgh reports that the decrease in the hot weather is much less marked this year than is usually the case.

CAN'T GET PLATE TO MAKE THE BOILERS

And So Work on Canadian Government Contract Has Been Held Up For Some Time

TORONTO.—Some nice orders are being handled by machine tool houses in Toronto—orders that run into a good many thousand dollars. Of course the great bulk of it centres around the war contracts. Some of them are not altogether in the category of war business, from the standpoint of munitions. For instance, Fairbanks-Morse have just completed the placing of a good sized order for the Aviation Department of the Imperial Munitions Board. This is for the fitting up of an engine repair park for the flying camps in this district.

Dealers are getting better deliveries from many of the shops where they had placed contracts, especially for single purpose machinery, and on this account deliveries of shells will be hastened to that extent. One of the officers in the American section of the Imperial Munitions Board expressed himself as well pleased with the work of the Canadian war contract shops. Discussing the matter with a representative of CANADIAN MACHINERY the officer in question intimated that the reports that were sent to Washington regarding output and progress were not outdone by any report reaching the American capital from the various branches in the republic. He stated that the work here was being well done, and that they were receiving every assistance from the officers of the Imperial Munitions Board.

The steel situation does not improve. It is becoming a harder matter to secure material from the States, and the fact that a person gets a license does not mean that the goods will be delivered. In fact this shortage of material is causing the holding up of a good many enterprises in this district that would run into the thousands and millions.

Can't Get Supplies

The big contractor is suffering with the little fellow. For instance the firm that is making the boilers for the new Canadian Parliament Buildings at Ottawa has been held up now for almost two months because the plate cannot be secured from the rollers to permit the firm to go ahead with the work. As the season is getting well advanced some of the authorities are anxious to get progress with the work, and one of the Canadian cabinet ministers has taken the matter up in an effort to have the Ottawa order included in the Canadian allotment. As one of the Toronto dealers put the case to-day: "Our experience is that it is not much of a trick to get a license and a priority certificate. Once a person is armed with all that paper he imagines when he approaches the rollers that it will be simply a case of going in and looking over the stock and filling your order from it. But you find that your man at the mill is not very much impressed with all your documents. He tells you that he will place the order on his books, and he will also tell you that there are a whole lot of people in possession of just the same sort of official documents that you counted on to move all obstacles out of the way for you. Our experience is that priority orders and licenses are not nearly as formidable and as powerful as one might think."

Some Tubes Coming In

One Toronto firm got in a good sized shipment by lake of boiler tubes. They were of the seamless variety, and there seems to be more of these on the move than of the lapweld. There has been a decided shortage of the two-inch size, but apparently there has been some relief in the supply of skelp, which has been blamed for some time past for holding up the finished tube.

As intimated in these columns of last week, prices on galvanized sheets have advanced 50 cents per hundred, and there has been an increase in the black sheets, but hardly to the same extent.

Plate Price Agreed On

The price quoted for plate for some time past has been around the $10 mark, and it seems likely that this will continue as the basis of trading for some time to come. Although no announcement has been made, it is generally understood that the Government and the jobbers have come to regard the $10 per hundred price as a fair point for the selling of plate. A few sales are made slightly under that point, but not many. The Government has sanctioned an f.o.b. price of $7.50 at Canadian mills and another cent can very well be added before the material is placed in warehouses here.

It is interesting to recall, in view of the $10 price that it is not very many years ago since plate was quoted at Pittsburgh around the $1.05 mark. Sales were made from Toronto warehouses right along around $2.50, just one-quarter of the present price.

Recognizing Scrap Workers

An incident in the Pittsburgh district recently has an interesting bearing on the scrap metal situation. The War Industries Board has given recognition to those working in scrap yards that they are engaged in work that comes under the heading of "useful" and approved of by the war authorities of the republic. This is done at a time when supplies are gradually being denied to many concerns that in times of peace would be inclined to look askance at the scrap metal dealers.

There is not a very great amount of trade passing in the scrap yards. Dealers here state that the mills are well filled up with heavy melting stetel, and they are to a large extent rather at a loss to know where it is coming from. One of the dealers stated this morning that a rolling mill had almost 800 cars of scrap in the yards and on the way, and were refusing to take on anything else, claiming it was not graded up to their requirements. There is still a shortage of good machinery scrap, and any of the yards here would be glad to take on a lot of business in this direction. Prices are tight just now, and those in the trade state that it is not possible to get a cent over the market price.

Still All War Business

The dealers here are still handling big orders. Most of them can be traced directly to war business. There is nothing in this to indicate that other lines have gone out of action, but it is the result of war pressure, and the unsatisfied demand for supplies. Some of the shops in Toronto that are handling the 9.2 orders have started work on the first one or two operations, but little progress has been made as they do not wish to fill up their shops. The desire is to get a steady flow through all operations at the same time. There is delay in some quarters on account of not being able to secure tools on the time notice given. High speed goods are still in big demand with prices unchanged.

COMBING COUNTRY FOR SCRAP BRINGS ONLY SMALL AMOUNT IN

THE importance being assumed by the scrap metal situation at the present time would almost warrant some better name being coined for this trade. Certain it is, that never before in many years has there been such a diligent search for the elusive second-hand metal as is going on all over the country at the present time. Foundries, finding themselves short of pig iron, are making that shortage up in many cases by introducing a much larger percentage of scrap than is usually the case. Open hearth furnaces are also on the market all the time for scrap. Reports from U. S. points are as follows:

Pittsburgh.—This great steel centre, it is estimated, consumes about 44 per cent. of the entire scrap output of the country and against this there is produced here only about 24 per cent. of the amount, so that even under ordinary conditions it has to depend upon outside sources for a good 20 per cent. of its supply. The trouble here just now is that these outside sources cannot be drawn upon as they are making use of all their own scrap. Although shell steel turnings are being made in greater quantity than ever before, it must be remembered that they are also being consumed as fast as they are produced.

Boston—The labor situation has not improved at all in this district and it is very safe to say that the labor shortage is making it impossible for the yards to handle one-half of the business that could be carried by them.

New York—A continuous and persistent demand has forced up the prices on stove plates and grates to the maximum limits of the market. The intensely hot weather of the past few days has had a telling effect on the volume of business carried and a number of the yards have been curtailing operations to a considerable degree.

Philadelphia.—A ruling that has been made by Provost General Crowder regarding employees of scrap yards will have considerable interest all over the country. The point was raised as to whether employees of these places would be considered as working at essential or non-essential occupations and the ruling of the authority in this case is that those working in scrap yards are carrying on business that is regarded as being essential and is placed in the class of useful work. There is a very keen demand here for all grades of scrap and this tends to keep supplies scarce and also to limit the number of sales.

Buffalo—Many of the consumers here are handicapped by a great shortage of labor and a number of the dealers are in even worse shape. As a matter of fact there is not a very great deal of scrap in the dealers' yards, as the most of it moves out almost as quickly as it arrives.

Cleveland—A number of the dealers here are wondering what will happen on October 1st, for on that date it is anticipated that the scrap and steel prices will be revised again for the next three months.

Youngstown—A very large number of the dealers here are short at the present time and are fearing that an increase in prices will come, as they are hearing constant complaints from the producers that the present prices being paid are too small for them to do business on. A man who has scrap to sell here at the present time can very easily find buyers, but the buyers in a great many cases find it very hard to find the sellers.

Chicago—The usual sources of scrap here are not yielding as much material as formerly and the railroads are doing comparatively little to help on the situation. In nearly every line prices are advancing gradually and nearly all of the items will be at the Government maximum shortly.

Cincinnati—There are two things that stand out prominently in the market situation here right now—one is the increased demand and the other is the decreased supplies of scrap. The dealers are not making predictions as to what the outcome of this situation may be.

St. Louis—Dealers here are making every effort to secure increased tonnages but they are rewarded with only indifferent success. Very little of the railroad scrap ever reaches the yards now as there seems to be a disposition on the part of the officials to deal direct with the consumers.

Clutches.—Hill Clutch Co., Cleveland. June issue of "Hill Clutch Equipment." Mentions an installation of clutches and bearings at the Baker R. & L. Co. for the testing of automobile engines. A description of the equipment employed is presented, supplemented by two illustrations of the engine testing section and others of the bearings and clutches used.

HABIT OF "TAKING HOLIDAYS" INTERFERES WITH PRODUCTION

Special to CANADIAN MACHINERY.

SYDNEY, N.S., August 14.—The contract for the excavation and foundations of the new plate mill at the Dominion Steel Company's Sydney plant has been let to the Bate-MacMahon Co. and work on this contract was commenced on the 7th August, which is stated to coincide curiously with the date when the first sod was turned for the plant itself, namely 7th August, 1899, or nineteen years ago exactly.

The plate mill itself is being furnished by the United Engineering Company of Pittsburgh. The Dominion Bridge Co. is furnishing the structural material for the mill buildings.

While no exact date can be given in connection with construction work under present day conditions, it is thought that the plate mill may be in actual operation before Christmas, 1919.

Taking "Holidays"

The employees of the Dominion Steel Company have on two successive Sundays taken a "holiday" as a protest against the non-granting of their wage demands in full. In May, a Royal Commission considered this matter and made certain recommendations which the Steel Company fulfilled to the letter, and in addition gave further substantial increases to classes which had not been included in the recommendations of the Royal Commission. Still further increases have been promised, but nevertheless the employees have taken the extraordinary course mentioned. A "holiday" on Sunday is just as injurious to a continuous process operation as a holiday on any other day, and as a result the production of the plant has been interrupted in each instance for half the week following the "holiday." The proceeding is a profitless and inept one on the part of the workmen, for it reduces their earnings, both as to day rates and as to tonnage earnings, and of course, it has the still more important consequence in these days of reducing the production of munitions steel. The idea of taking this "holiday" on a Sunday is a subterfuge, and not a particularly subtle one at that.

Pro and Con Argument

A certain number of the workmen object on conscientious grounds to working on Sundays, but as was proved very clearly before the Royal Commission, a still greater number prefer to work on Sundays, and indeed to get in as much overtime as possible. The real desire of the workmen is to be paid time and a half or double time for Sunday labor, which, in a continuous process, merely amounts to a demand for a general increase in wages. The long week-end shift which is called for every alternate week in the case of twelve-hour men is objectionable, but the alternative is a serious one. It is nothing more than the adoption of a three-shift system covering the 24 hours in lieu of a two-shift system. Short of this change in system, there is no possible means of avoiding Sunday work, or the long week-end shift every fortnight. Some day this revolutionary change may come about in steel works, but the present time of labor shortage and extraordinary demand is not the best moment to choose for enforcing such a change.

The Attitude of Ottawa

The attitude of the Labor Department at Ottawa has recently been to put most of the onus for labor disputes upon the employer, it being apparently the idea at Ottawa that nothing is easier than to raise wages and shorten hours because trade conditions are so prosperous, but here is an instance where the employers have far exceeded the recommendations of a judicial body appointed by the Government to investigate and recommend an equitable settlement, and while recalcitrance on the part of the employer would doubtless have been quickly dealt with by Ottawa, when the fault lies with the workmen, the Government is apparently unable to take any effective action.

According to the agreement between the Amalgamated Mine Workers and the coal operators in the Sydney district, an advance in wages becomes effective 1st July, calculated on the increase in the costs of living which are supposed to have taken place between the 1st of January and the 1st of July. There is some difference of opinion as to the true amount of this increase, but there will be no difficulty in arriving at a settlement. The company has offered an increase of 20 cents per day to all workmen, plus certain bonuses to the men at the coal face, and it is likely the offer will become the basis of the settlement.

FORD TO DOUBLE HIS TRACTOR OUTPUT

Many Big U. S. Plants Hasten to Turn Over to Making War Materials

Special to CANADIAN MACHINERY.

NEW YORK, Aug. 14th.—War work is absorbing manufacturing capacity of the country to a greater extent than ever before. In the last ten days, several important industries that heretofore have kept within the limits of their ordinary work, have turned with avidity to the manufacture of shells, airplane motors and other munitions which go directly to the army and navy. The Government has distributed several large orders for trench mortar shells, illuminating projectiles, gun parts, mechanisms and airplane motors.

Cars to Plane Motors

The Pierce-Arrow Motor Car Co. has come into the market for several hundred machine tools which will be used in converting its Buffalo plant, previously used in the manufacture of pleasure cars, into a factory for the production of airplane motors on a large scale. It is planned eventually to manufacture fifty Hispano-Suiza airplane motors a day. It is hoped by January 1st to turn out thirty motors a day.

The U. S. Cast Iron Pipe & Foundry Co., which has found much difficulty recently in obtaining enough pig iron to keep its plants operating 50 per cent. of capacity, has turned to war work, having accepted a large contract from the Government for 6-inch cast iron and steel shells upon which some external machine work will be necessary. The orders will be executed at the Burlington, N.J., and at the Alabama shops at Birmingham and Bessemer.

The Laclede Gas Light Co. of St. Louis, has accepted a large contract for projectiles and is equipping a factory which will duplicate that now being constructed by the Scullin Steel Co. Each of these plants will have a capacity to produce 300,000 150 mm. and 240 mm. shells a month.

The Savage Arms Corporation, Sharon, Pa., is buying additional shop equipment to increase output of guns and is now making extensions to its Isaac Sheppard & Sons plant at Philadelphia and at its Defiance Manufacturing Works at Somerdale. The Midvale Steel & Ordnance Co. has finally awarded its large contract for cranes for the Nicetown plant, equally between the Morgan Engineering Co. and the Alliance Machine Co. of Alliance, Ohio.

The Bureau of Supplies and Accounts, Navy Department, has put out a list of sixty-four machines which are to be purchased and installed in the Washington Navy Yard. Specifications cover 24 drill presses, fifteen milling machines and nine boring machines. The quartermaster's department of the army is still in the market for twelve semi-portable bridge cranes which are to be established in the mammoth stores now being constructed at Boston.

Railroads and railroad equipment manufacturers are making some purchases of shop equipment for the building and repairing of motive power. The Lima Locomotive Works, Lima, Ohio, is enlarging its plant to give it capacity to produce fifty instead of thirty locomotives a month. The Norfolk & Western R. R. has asked for bids on forty machine tools and the Nickel Plate has begun to purchase against the revised list of tools which it originally put out last February.

Shipbuilders continue actively in the market. The Federal Shipbuilding Corporation has bought a large amount of hydraulic machinery in Philadelphia and also ordered several additional cranes for its Kearney, N.J., shipyard. The Downey Shipbuilding Corporation has bought sixteen machines to be installed in its machine shop at States Island. The Sun Shipbuilding Co., Chester, has bought more cranes and machine tools. The New York Shipbuilding Corporation has also made additional purchases of fabricating machinery. Henry Ford & Son are preparing to enlarge their plant in Dearborn, Michigan, in order to produce 150 tractors a day. The Wisconsin Gun Co. has purchased machinery which will double its capacity.

FURNACES ARE NOT TURNING OUT ENOUGH PIG TO SATISFY MARKET

A SURVEY of the situation in the United States at the present time makes it increasingly certain that those industries there that are working on war contracts are receiving a very decided preference. In fact it amounts to this, if an industry is not working on essential work, the chances of it receiving sufficient supplies to keep in operation are very poor indeed. A review of the conditions existing at present in the pig iron centres of United States gives the following information:

Chicago—One deal that was sanctioned by the Government here this week makes it apparent that for the first time in some days manufacturers of railway equipment are going to receive some consideration at the hands of the Government. In the case referred to an allotment of 7,500 tons of basic iron was made to a leading independent steel maker to be worked up into railway equipment.

Boston—Manufacturers of stoves in this district are making a strenuous fight to see if they cannot have greater supplies released to them and some of them are using rather ingenious methods to secure these. For instance, the oil stove manufacturers are arguing that their products in causing the non-use of coal are serving a double purpose in conservation—crude and fuel. Indications are, however, that they will hardly get past with his claim, and they are not likely to receive any more iron than they have been doing in the past. In accordance with the desires of the Government, no iron is being sold for 1919 delivery.

New York—It would not be a very hard matter for any person to book a large amount of 1919 business here, but the Government has requested that this policy should not be followed and for that reason 1919 business is not being booked at the present time here.

Philadelphia—The intense humidity of the past few days has been considerably affecting furnace operations in this district. In a few cases, Eastern furnaces are booking occasional orders from regular customers for iron for first half of 1919 delivery, but these cases are very much the exception rather than the rule.

Pittsburgh—The trend of war trade and industry can be noticed here in a great many ways, one of them being the increasing number of consumers of pig iron that are shifting from non-essential to essential production. This has made it necessary to some extent to revise the lists already made out by the Government in connection with these industries. The War Board discourages the idea of uses of pig iron except in contracts without first having assurance that they will be able to obtain their raw material. Furnace operations are unusually heavy, but it seems unlikely that production will be large enough to meet all the essential demands.

Youngstown, Ohio—The situation in regard to pig iron in this district can very accurately be described as a serious one at the present moment. Producers of pig iron declare that they cannot see their way clear for months to come and are very much alarmed over conditions.

Buffalo—Any concern in this district that is producing any pig iron seems to be quite satisfied at the present time to allow the Government to take over the functions formerly discharged by its sales staff. They seem to be quite confident that Washington will be able to take care of the production of all their furnaces.

St. Louis—Inquiries here bring out the information that foundry iron for non-war usage is rapidly shrinking to very small dimensions. Shops that a month or six weeks ago were hoping to be able to continue operations are now taking a very pessimistic view. It is estimated that with what they have now on hand and what is on the road and by the generous introduction of scrap, a number of plants will be able to operate until the end of October, but it is almost certain that from that time on there will be a continued falling off of the operations.

HOT WEATHER BROUGHT SMALLER DECREASE THAN USUAL IN PRODUCTION

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., Aug. 15.—A thorough canvass has been in progress as to the feasibility and desirability of increasing the output of steel by new construction. Not only the sanction, but also the hearty co-operation of the War Industries Board would be requisite before anything could be undertaken. A large amount of labor would be required, also a great deal of material, and much transportation would be involved and the matter would have to be considered from all angles. While the steel industry is fully able to finance its new construction itself, when it is new construction dictated by prospects of making money, the new construction that would be requisite at this time would not have such a future before it. After the war the industry would be left in an unbalanced condition. Indeed, it is only because the industry is quite out of a state of balance by reason of the peculiar nature of the war demand that it becomes feasible to increase the output of finished material by a relatively small volume of new construction. Study has shown that many of the finishing branches of the steel industry are quite insufficiently supplied with raw steel in the form of ingots, blooms and billets because such a large amount of raw steel is withdrawn from the situation by the demand for shell steel and the extra demand for plates. By the erection of a large number of open-hearth steel furnaces and a number of blast furnaces the production of finished steel would be greatly increased. The finishing capacity is already available, being indeed idle at present in considerable part, while there is also in prospect sufficient coke and sufficient Lake Superior iron ore to take care of many additional blast furnaces. If men, materials and transportation facilities were withdrawn from other activities to a sufficient extent the new capacity might be completed in the course of about six months, the question being whether it would be enterprising to make such withdrawals.

Plenty Lake Ore

Shipments of Lake Superior iron ore down the lakes in July totalled 10,659,203 gross tons, the record for any month in history, and bringing the season total to August 1 up to 29,608,933 tons, which presages a total movement for the season of about 65,000,000 tons. This is 10,000,000 tons above the inside estimate made before the opening of navigation. At that time the railroads had only partially recovered from the great blockade of the winter, and the entire matter of moving ore for the coming season hinged upon the railroads. All the plans provided that the convenience of the railroads should be served, the boats only moving so fast as the railroads could serve them. Since then the railroads have gotten into excellent shape and there is no difficulty at all about moving ore.

Heavy Freight Movement

As an evidence of the railroad situation, the latest statistics are for April and they show that even in that month the railroads moved freight at the rate of about 448,000,000,000 ton-miles a year. Prior to 1916 the best fiscal year total was 301,398,752,108 ton-miles, in the fiscal year ended June 30, 1913. The best posted shippers in Pittsburgh always contended, when the railroads were so badly blockaded last winter, that what they needed was system and locomotives. Government control has given them system and the locomotive shops have furnished many locomotives. Shippers did not feel that the railroads needed cars at all badly, for indeed one trouble was that the existing cars were blocking the tracks. Since April, which showed the freight movement just noted, there has been a further and great improvement in the railroad situation.

Steel for Jobbers

The pipe and wire mills find they can do fairly well in carrying out the War Industries Board's program as to shipments to jobbers during August, it being permissible to ship as much steel in August, as the monthly average shipped during the first half of the year In sheets and merchant bars it will be difficult to ship more than a fraction of the tonnage permitted. Some of the pipe mills had already received specifications from their jobbers during the first week in Auust. The American Steel & Wire Company issued a circular to its

Continued on page 73.

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	$32 75	
Lake Superior, charcoal, Chicago	37 50	
Standard low phos., Philadelphia	.....	
Bessemer, Pittsburgh	37 25	
Basic, Valley furnace	33 40	
Government prices.	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	125 00	125 00
Spelter	11 00	11 00
Lead	10 50	10 00
Antimony	15 50	18 00
Aluminum	50 00	58 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Effective Feb. 5, 1918.

	Black	Galvanized
Standard Buttweld	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 16	7 29
⅜ in.	5 16	7 29
½ in.	6 55	8 12
¾ in.	8 28	10 41
1 in.	12 24	15 39
1¼ in.	16 56	20 82
1½ in.	19 80	24 89
2 in.	26 64	33 49
2½ in.	42 72	53 53
3 in.	55 85	70 00
3½ in.	70 84	87 86
4 in.	83 93	104 10
Standard Lapweld		
2 in.	$ 29 60	$ 36 08
2½ in.	44 46	54 70
3 in.	58 14	71 53
3½ in.	72 68	90 62
4 in.	86 11	107 37
4½ in.	97 79	122 56
5 in.	114 00	142 82
6 in.	147 80	185 28
7 in.	192 80	241 57
8 L in.	202 50	253 75
8 in.	233 30	292 32
9 in.	279 50	350 18
10 L in.	259 20	324 80
10 in.	333 70	418 18

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES

4" and under, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	25 50	24 50
Copper, heavy	25 50	24 50
Copper, wire	24 50	25 50
No. 1 machine composition	23 00	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	26 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs	9 00	8 50
Cast borings	12 00	12 00
Stove plate	26 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	8 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright	9 50	10 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 70
Premier, 10¾ oz.	.....	10 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	37½
Disston	50
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

Colored.

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

Wool Packing.

Arrow	25	Anvil	16
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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

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AND MANUFACTURING NEWS

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CANADIAN MACHINERY
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Shrapnel First Used in Peninsular War

Shrapnel Originally Invented by Lieut. Henry Shrapnel—In Its Early Form Very Different From Present-day Shrapnel, and Was Used in Muzzle-loading Cannon

By J. N. ROBINSON

MECHANICAL appliances for throwing projectiles were produced early in the history of organized warfare, and "engines invented by cunning men to shoot arrows and great stones" are mentioned in the Old Testament. These were continually improved, and under the various names of catapulta, balista, onager, trebuchet, etc., were employed throughout ancient and medieval warfare.

The machines finally produced were very powerful, and even when a propelling agent as strong as gunpowder was discovered and applied, the supersession of the older weapons was not effected suddenly nor without considerable opposition.

The date of the first employment of cannon cannot be established with any certainty, but there is good evidence to show that the Germans used guns at the siege of Cividale in Italy in 1331.

The first guns were small and vase-shaped. Towards the end of the 14th century, however, they had become of huge dimensions, firing heavy stone shot of from 200 to 700 lb. weight. A gun of this latter type is still extant in the Bombarde de Ghent, called "Dulle Griete." It weighs about 13 tons, is 197 inches long and has a bore of 25 inches. It fired a granite ball weighing 700 lbs.

The first projectiles fired from cannon were the darts and stone shot which had been in use with the older weapons. These darts had iron heads or were made of iron, and were wrapped with leather to fit the bore of the small guns, and continued in use up to nearly the end of the 16th century.

Stone Much Cheaper

Spherical stone shot were chosen on account of their cheapness. Lead, bronze, and forged iron balls were tried, but their cost prevented their general adoption. Further, as the heavy metal shot necessitated the use of a correspondingly large propellng charge, too great a demand was made on the strength of the feeble guns of that period. Stone shot being about one-third the weight of those of metal, the powder charge was reduced in proportion, and this also effected a great economy.

Both iron and stone shot were occasionally covered with lead, probably to protect the bore of the gun. Cast iron, while known in the 14th century, was not sufficiently common to be much used in the manufactnre of shot, although some small ones were made about that time. They were used more frequently at the latter part of the following century. Towards the end of the 16th century nearly all shot were of iron, but some stone shot were still used in certain styles of guns for attacking weak targets such as ship at short range.

Various Kinds Were Used

In the 16th and 17th centuries various other kinds of projectiles besides the solid ball were used. Amongst these were the following:

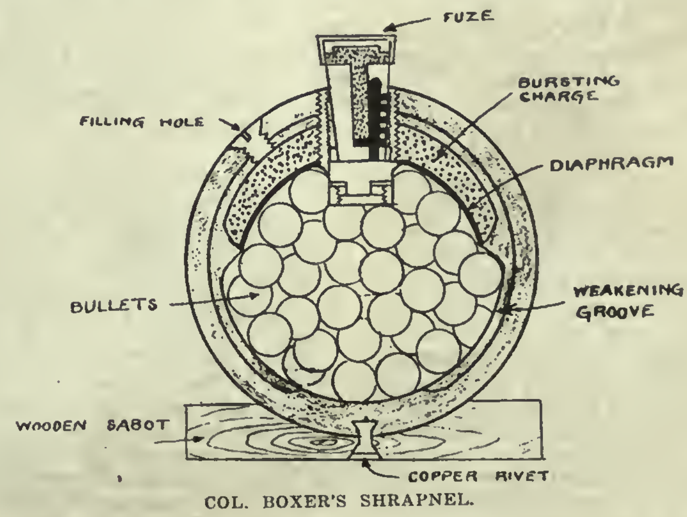
Case shot.—These are nearly as ancient as spherical shot and can be traced back to the early part of the fifteenth century. In the earlier forms lead or iron shot were packed in wood casks, in canvas bags or in cylinders of sheet iron. These shot were really the forerunners of our present shrapnel shell.

Grape shot.—This is now obsolete. It generally consisted of three tiers of cast iron balls, separated by iron plates and held in position by an iron bolt which passed through the center of the plates. Three was also another type called "quilted shot," which consisted of a large number of small shot in a canvas covering, tied up with rope.

Chain shot.—In the days of sailing ships these were in much favor as a means of destroying rigging. Two spherical shot were fastened together by a short length of chain. On leaving the gun they began gyrating around each other and made a formidable missile.

Red hot shot were invented about 1580 by the King of Poland. They were used with great success by the British during the siege of Gibraltar.

Marten's shell was a modified form of the latter. Here a cast iron shell was



COL. BOXER'S SHRAPNEL.

filled with molten iron and immediately fired. On striking the side of a ship the shell broke up freeing the molten metal, which set fire to the vessel.

The Steps of Progress

From the early history of ordnance we see great changes in size, shape and build of cannon and projectiles from the 14th to the 17th centuries. From then on until the middle of the 19th century, very little progress was made. About 1854 breech-loading rifled guns began to replace the old muzzle-loading smoothbores, and from then on until the present time we see enormous progress.

Explosive shell do not appear to have been in general use before the middle of the 16th century. About that time hollow balls of cast iron were fired from mortars. These balls were nearly filled with gunpowder and the remaining space with a slow burning composition. This plan was unsatisfactory as the composition was not always ignited by the flash from the discharge of the gun, and moreover the amount of composition to burn a stipulated time could not easily be gauged. The shell was therefore fitted with a hollow forged iron or copper plug filled with slow burning powder. It was impossible to ignite with certainty this primitive fuse simply by firing the gun. The fuse was consequently first ignited and the gun fired immediately afterwards. This entailed the use of a mortar or a very short gun, so that the fuse could be easily reached from the muzzle without unduly endangering the gunner. Cast iron spherical shell were in use up to 1871. For guns they were latterly fitted with a wooden disc called a sabot, attached by a copper rivet intended to keep the fuse central while loading.

The Work of Shrapnel

In 1784 Lieut. Henry Shrapnel, R.A., ((later Lieut.-Gen.), soldier and inventor, took up the study of hollow projectiles. He invented the forerunner of the present shrapnel shell. This shell was spherical in shape and was filled with lead bullets mixed with the bursting charge. A fuse arrangement, the same as that described for common shell was used.

In 1803 this shot case or shell was recommended for adoption into the service, and in the following year was first employed at the battle of Surinam. The results of its use in the Peninsular War were highly satisfactory to Wellington.

Although far superior to common shell in man-killing effect, their action was not altogether satisfactory, as the shell, on bursting, scattered bullets in all directions, and there was a liability to premature explosion.

In order to overcome these defects, Col. Boxer, R. A., separated the bullets from the bursting charge by a sheet iron diaphragm. The bullets were also hardened by the addition of antimony. Then, as the bursting charge was small the shell was weakened by four grooves made inside the shell and extending from the fuse hole to the opposite side.

The Shape was Changed

When breech-loading rifled guns supplanted the old smooth-bore muzzle-loaders, great changes were made in the shapes of the projectiles. Upon experimentation it was found that an elongated, sharp-nosed, shell would carry farther and more accurately than those of spherical shape, and these latter were gradually abandoned.

This new form was eventually used in the manufacture of shrapnel. But although its form was altered its character remained. The body of the shell was still made of cast iron, with a cavity at the base for the bursting charge, on this was placed a thick steel diaphragm, separating the bullets from the charge with a brass tube which communicated the flash from the nose fuse to the bursting charge. The body was filled with hard lead bullets and a wooden head covered with sheet iron or steel surmounted it and carried the fuse.

The new-shaped, elongated projectiles were at first fitted with gun-metal studs arranged around them in a spiral manner corresponding to the twist of the rifling of the gun. This was defective, for it allowed—as in the old smooth bores—the powder gas to escape through the clearance between the shell and the wall of bore (called the "windage") with a consequent loss of efficiency; it also quickly eroded the bore of the larger guns.

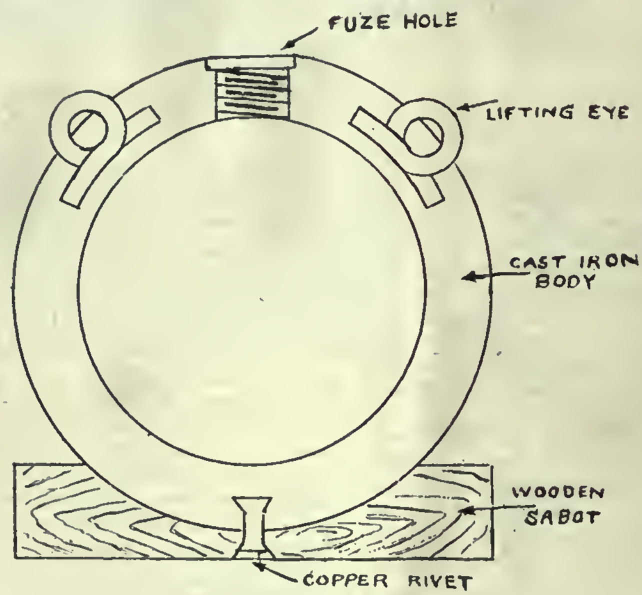
Many schemes were tried to give the shell rotation, and at the same time stop the leak of gases past the shell. In one case the bore of the gun was hexagonal in shape, with the shell to correspond. Another was elliptical. However, none of these produced the desired result.

Improvements Followed

Later the rotation was effected by a cupped copper disc called a "gas check" attached at the base end of the projectile. The powder gas pressure expanded the rim of the gas check into the rifling grooves and prevented the escape of the gas; it also firmly fixed the gas check to the projectile, thus causing the shell to rotate. A more regular and efficient action of the powder gas was thus ensured and a greater range and improvement in accuracy effected.

The late Lord Armstrong invented a shell coated with lead, which was forced into the rifling grooves of the gun by the pressure of the exploded powder gas. However, this lead coating proved too soft for the higher velocities of the modern guns.

Mr. Vavasseur, C.B., devised a plan of fitting, by hydraulic pressure, a copper "driving band" into a groove cut around the body of the projectile. This is now a universal practice with all kinds and sizes of shells. It not only fulfills the purpose of rotating the projectile, but renders possible the use of large charges of slow-burning explosive.



CAST IRON SPHERICAL SHELL.

Projectiles vs Armor

On the introduction of iron sheeted ships it was found that the ordinary cast iron projectile readily pierced the thin plating. Then, in order to protect the vital parts of the vessel wrought iron armor of considerable thickness was placed on the sides. It then became necessary to produce a projectile which would pierce this armor. This was accomplished by Sir W. Palliser, who invented a method of hardening the head of the pointed cast iron shell. These shells proved satisfactory against wrought iron armor but were not serviceable against compound and steel. Forged steel shell took the place of the Palliser shell. Carbon steel was first used, but as armor improved in quality projectiles followed suit, and the latest type of shell are formed of steel—either forged or cast—containing both nickel and chromium. Tungsten steel has also been used with success.

By making the body of toughened steel and by slightly reducing the size of the bullets, the number of these was much increased. Thus, with the cast iron body the percentage of useful weight, i.e., the proportion of the weight of the bullets to the total weight of the shell was from 26 to 28 per cent., while with the modern steel shell it is from 47 to 53 per cent. The limit of the forward effect of modern shrapnel at effective range is about 300 yards, and the extent of front covered is about 25 yards.

This is indeed a far cry from the first spherical shrapnel which were liable to burst anywhere from the time they left the muzzle of the gun to when they hit the ground, and threw bullets promiscuously in all directions—or did not burst at all—to the highly efficient modern shrapnel shell such as used by the famous French and American quick-firing "seventy-fives," and the British "eighteen pounders," which hurl shell with a rapidity almost unbelievable and with an accuracy which seems uncanny to the novice.

A USEFUL CU-FE-ZN HIGH TEMPERATURE BRONZE

By M. Mark.

It is fairly well known that pure iron and copper will alloy together in almost any proportion, and it is also fairly well known that aluminum will alloy with both iron and copper in the absence of carbon, and while it also acts as a flux for both metals, a boron derivative has better effect. It is also fairly well known that bronzes which hold iron resist corrosion well, provided the iron is alloyed with the copper and is not a mere mechanical mixture. Zinc and tin will alloy with both iron and copper, provided there is no carbon present in the iron but in the presence of carbon, or when the iron is unskimmed and covered with dirt, trouble arises in practical working.

Absolutely pure, carbon-free iron is, of course, not commercially obtainable, but very fair samples can be had in the form of Swedish bars of some brands, some forms of boiler plates, and some brands of mild steel, the amount of carbon held both in the combined and graphitic states being extremely low, and while this in itself is a disadvantage it does not prevent alloying with copper up to perhaps 30 per cent. iron to 70 per cent. copper, where care is taken, and indeed, with many practical tests alloys that would roll well and also draw into tubes were produced with a content up to 20 per cent. iron, but above this there appeared to be trouble.

In all cases the procedure was to melt the iron, add somewhere up to 25 per cent. carbon-free ferro-aluminum to the iron, and when reaction practically ceased, the dirt was skimmed, and the copper heated to redness, put in and melted, the zinc made as hot as possible, being finally added, and then after stirring and skimming the metal was poured into ordinary sand moulds or metal ingot moulds as the case may be, the metal moulds being thickly lime-washed and dried prior to the molten metal being poured into them. In these cases, Swedish iron of the best quality was used, and for this reason the aluminum was low, but with some broiler plate punchings and other scrap irons of less purity up to 0.30 per cent. of aluminum was necessary, this necessitating a much larger percentage of ferro-aluminum. In any case, the amount necessary to secure the best results would have to be determined in the laboratory; but a small excess of aluminum would not matter, although it would increase the cost of the alloy. In every instance the exact composition of the alloy must be determined by practical trial to secure the best results in regard to the articles for which it is used, this being a very essential point, because not only do the metals used vary in content, but different degrees of hardness and strength are desirable under varying circumstances.

As the melting point of wrought iron is high, probably in most cases forced draught will be necessary in the furnaces, which, for the sake of economy, should hold four 75-lb. crucibles of the upright or barrel type, but of course, single pot furnaces can be used. In any case, from 2750° F. to 2975° F. must be secured or the iron will not melt readily. and where a somewhat higher temperature can be managed all the better; but this implies about the maximum refractoriness in both furnace linings and crucibles. Usually it takes about two hours to melt iron in a good furnace, while in a bad one it may take much longer, or the iron may even refuse to melt.

The crucibles should be of clay—in which case they only stand one day's work—or of plumbago with clay liners, as made by the Morgan Crucible Company, to take one instance; in either case the cost for crucibles being much higher than for ordinary bronze; but even at this the cost of the Cu-Fe-Zn alloy works out at very much less than the ordinary Cu-Zn bronze, when all costs are taken on a pre-war basis.

It must be particularly insisted on that the absence of carbon is the crucial point, but conjointly with this silicon must also be absent or the iron or alloy will absorb carbon and soon become a mere mechanical mixture of metals of more or less—generally less—perfect combination, which are liable to dissociate at very small provocation. In the experimental work carried out by the writer, both in regard to this alloy and to "Mitia" iron castings, it appeared that while a small percentage of combined carbon was not seriously objectionable so far as untested apparent effect was concerned, the presence of even 0.25 per cent. of graphite carbon had a very prejudicial effect, and in cases where grey cast iron was used in part or whole substitution of the wrought iron, a very imperfect mechanical alloy was secured in which the iron floated, and this quite independently of the presence of either tin or zinc or both combined. The only way by which a good mechanical alloy of copper and cast iron was produced was by the addition of aluminum in sufficient quantity to (on paper) make the specific gravity of the Cu-Al combination equal to that of the iron. In each case the trials were of a practical commercial character, not less than 56 pounds of the alloy being made at each operation.

There are no patents in force for the making of the bronze alloy mentioned, "Mitza" malleable wrought iron, or artificial "Monel" metal, which is an alloy of nickel, copper and iron, and the only real difficulty in making these things is the high heat necessary and the absence of carbon in the metal. Good alloying skill is, of course, a necessity, but this, of all things, must be taken for granted as a general thing.

NITER CAKE FOR PICKLING BRASS

By Mark Meredith.

Niter cake, as a substitute for sulphuric acid in pickling brass, is finding extensive use in Great Britain. The quantity so used in that country now runs into several hundred tons per week. Difficulty in obtaining raw material, coupled with the increased demand for sulphuric acid for other purposes, has resulted in an extended application of niter cake solutions in place of dilute sulphuric acid for pickling annealed brass.

Niter cake is essentially crude acid sodium sulphate, and while the latter in the pure anhydrous state contains theoretically 40.8 per cent. of sulphuric acid, the free acid found in niter cake may vary from 3 to 30 per cent. For pickning, the niter cake solution should show 3 to 5 per cent. sulphuric acid on titration; there is no advantage to be gained in using solutions of higher acid concentration.

While niter cake is a variable product, annealed brass from a pickling point of view may be even more so. Given clean work, niter cake solutions replace dilute sulphuric acid quite efficiently, but with dirty work the difference is much more marked, and niter cake solutions, even under the most favorable conditions, may fail to pickle the work satisfactorily. It is little consolation for the manufacturer to know, that his troubles lie in his annealing furnaces. Much may be done to overcome troubles as follows:

The niter cake solution should be as hot as possible. Its acid content should be tested frequently and maintained at 3 to 5 per cent. by the addition of niter cake. The hot annealed products may be quenched in water, whereby much scale is mechanically loosened prior to pickling.

The hot annealed work may be placed direct into the niter-cake solution, and the pickle can thus be maintained at a high temperature without auxiliary steam heating.

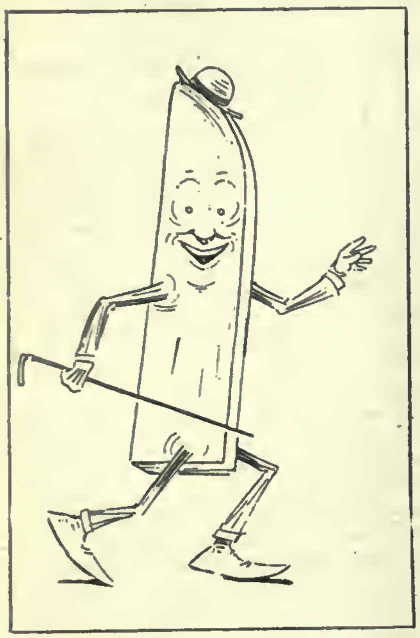
Electrochemical aid might be sought by using a low voltage current, making the lead lining of the vat the cathode and the work to be pickled the anode.

The difficulties met with in the successful use of niter cake solution can only be overcome in a satisfactory manner by paying close attention to the conditions governing the annealing so as to obtain the annealed brass as clean as possible, and by using the niter cake solution under conditions which will most strongly stimulate its pickling activity.

There's No Joy in Life for This H.S.S. Tool Bit

Things Used to Look Rosy When He Lay on Velvet in the Show Case, but the Life and Ginger Have Been Squeezed Out of Him Since Then—Real Sob Story by a Bit of Steel

By R. S. MYERS, BRIDGEPORT



WHEN H.S.S. WAS YOUNG AND KEEN

I AM a poor cripple. I have been twisted and contorted until I am nothing more than a mass of shapeless, sacrificed steel, with grains misplaced, sides twisted and out of line, grinds and cracks standing out here and there as a protest and protection against the friction of my square hole resting place, called a tool holder.

There was a time when I was fair to look upon. My skin was silvery and smooth like velvet. My sides were straight and shapely. My master was then proud of me. I enjoyed real freedom, the air and sunshine. Life then was a continual delight. But as I grew older my master became less thoughtful of me—he even left me in the tool holder locked up all night in the lathe tool post. I was not admired as much now. It was then that he began to criticize me—he discovered that I would not cut chilled iron and hardened steel. I soon realized that he considered me N. G., and my showings not up to the efficiency standards. He began by putting me into a fire that almost consumed me, and finished by dropping me in cold oil—I almost cracked on him on this occasion. I made him frown and grumble and scold for his ill-treatment.

My life thereafter was a steady torture. My master was hard for some time after he began ill-treating me, but I never knew a peaceful moment until I was turning C. R. S. or planing babbitt, when I would have a chance to work all day without being sharpened. But when the next day came I would again be thrust in my square hole chamber. At times I was almost split apart when a big monkey wrench forced the holding screw down on me. My close grain was forced so hard that the screw was actually expanded in the process.

I began to lose much of my feeling. I became hardened to suffering. I had to endure it. I was helpless.

Slowly and surely I lost my good shape, and my master's interest was less in a similar degree. I know on occasions he suffered lost time on account of his crimes against me.

Sometimes he would show me to some of the other boys and brag about how I cut such and such a steel at so many R. P. M., and at such times I would be hopeful. His sympathies for me and my hard knocks were at last awakening, but the next day I would again be similarly abused.

How I longed for my old home in the show case that greeted me in my younger days. My master then did not know about H.S.S.; true he could turn, mill, and shape, but when I came to him he was mighty proud of me and treasured me highly.

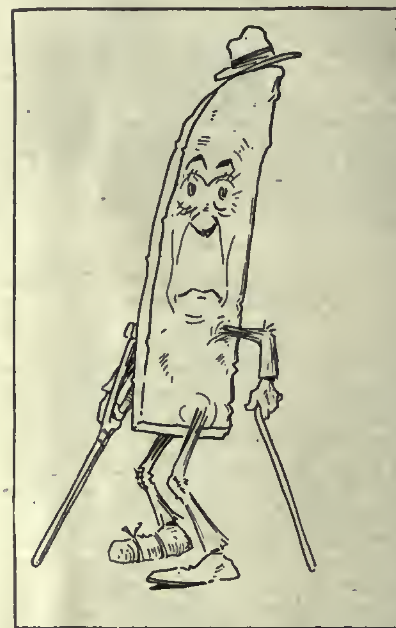
But when he began to crush the life out of me by welding me to a decrepit old piece of machine steel, he could not use such high speeds and feeds on his work. He finally lost his rep. for being the fastest workman in the room. His increased production was being replaced by minimum output. How I did abominate being welded to a simple piece of M. S. My master would attempt to force me to take a big bite, while I had all I could do to keep in my place—I broke my bonds twice, and was almost lost.

Now my master holds me on a M. S. shank in a more dependable way. His pride has borne many hard blows, but much of his trouble came because he maltreated me. He sold his record for the privilege of experimenting with me.

His reputation disappeared long ago. He has lost his energy, his enthusiasm. His record once on the production boards have been rubbed out. His interest has become indifferent.

And now my master blames me because I do not cut as at first. I chatter and squeak. He often complains, too, that the boss gives him no more "hurry up jobs." I tried hard enough to make him see that when ill-treating me he was injuring his reputation. He depended on me for a raise.

I gave him a proper foundation. Without my characteristics he could have never finished some of his jobs. Without my gifts he never would have held his job, and when he rehardened me—when



WHEN H.S.S. GREW OLD AND DECREPIT.

he melted me and chilled me beyond recognition, he paid the penalty in full. The joys of maximum production were his only so long as he gave me proper consideration.

Lack of head work made me a poor cripple. Hardened steel and chilled iron turned with the mistaken impression that I would "bite anything under the sun," robbed me of my greatest asset, and the price paid by my master for his folly was the loss of many dollars in his pay envelope years and years before they should have left him.

Many attempts have been made to weld the particles of tungsten together by working at a very high temperature. No headway has been made in this direction. To be workable, a piece of tungsten must be substantially nonporous—that is, the individual particles must have been previously welded together at a temperature near the melting point of tungsten in an atmosphere of hydrogen or other gas which is either helpful or at least not harmful to the tungsten. Sometimes the swaged tungsten rods split during the swaging operation. Attempts have been made to weld these split portions together by working at a high temperature. The highest temperature available was 1700-1800 deg. C. It was not found possible to weld the tungsten in this manner. Tungsten can be welded electrically at temperatures near fusion.

THE COMMERCIAL AWAKENING OF THE EAST

By Mark Meredith

JAPAN has thoroughly awakened to the possibilities of creating wealth and power by industry and commerce, and her neighbor China is awakening too, after a sort of sleep of many centuries for at one time she was, among the ancients, the foremost commercial nation. But the most interesting feature about the far East at present is the gradual development of a factory system, which is spreading, and travellers now talk about the factory towns of Japan and also of some parts of the industrial parts of China.

All the commercial centres are alive to the possibilities of development at the present time, for it is recognized that the greater the production of Japan in various articles and commodities which the Western Allies cannot give the time and attention to make the more she will keep the trade of the Allied nations going. The war has given the nations of the East many opportunities and as they are keen and enterprising business people they are taking full advantage of all that can be grasped. The Japanese were regarded as a coming force in the commerce of the world before the outbreak of the war but nowadays they seem to have "got there" for at various times many goods of Japanese origin have been on sale in towns all over Great Britain. There are many ways in which Japan is helping us in the shipbuilding, shipping and textile industries, and after the war she will certainly take her place as one of the great commercial nations of the East.

The position of Japan in the world freight market has witnessed a radical improvement since the war opened, but besides what has been achieved by the United States in this field of commercial activity, Japan's progress has been somewhat slow. The prosperity of the United States and Japan is due chiefly to Germany's submarine warfare, which has destroyed a large percentage of the world's merchant marine, and to the greater use of ships for war purposes by the belligerent powers. Great Britain has already lost nearly 45 per cent. of her merchant marine by the German submarine ravages and she has withdrawn many big merchantmen to carry troops and their requirements so that the greater part of her tramp fleet is not available for commercial purposes. Some regular liners have also been taken away from the trade routes where they had gained a firm footing through many years' steady work. From the far East, for instance, many well known liners have gone, and judging by the annual reports the directors of the different British lines, the results of wholesale withdrawal are viewed with anxiety for the places thus vacated are being filled rapidly by Japanese ships and the newcomers will gain a permanent footing.

It will be difficult for British lines to re-establish their influence and moreover, they will not have tonnage enough to do that. If Great Britain could afford to release shipbuilding yards from war service, the loss could be easily made good, but for the present nothing will be more difficult for that country to achieve. At least 600,000 tons of shipping are planned by her to be built, but it is too little to fill the gap. The United States, on the other hand, has been quite successful in enlarging her merchant marine, since the war opened. Although no accurate figure is available at present, it is beyond a doubt that her fleet has been more than doubled. Moreover, she is going to build a large number of steel and wooden ships for commercial use. In the far East the liners under the Stars and Stripes are still small in number, but on the Atlantic and in South American waters, their growing trade is striking.

Japan's gain since the war's opening is also striking. In the East she has, although not completely, succeeded in filling the gap created by Great Britain's withdrawal. On the Pacific also, most of the trade is hers. A most prominent instance of Japan's achievement is the Nippon Yusen Kaisha's inauguration of a Liverpool service. The regular trade on this particular route is now almost entirely carried on by the Nippon Yusen Kaisha, although in the Autumn of 1918 the Osaka Shosen Kaisha will start a service on this route. Japan has also increased her fleet immensely, in spite of the limited capacity of her yards, which is due to the precarious supply of steel.

In order to remedy this defect however, a law was passed at a recent special session of the Diet to encourage the iron industry. The main provisions of this measure are: (1) That iron and steel works with an output of not less than 35,000 metric tons per annum will have the right to expropriate the owners of property on which it is necessary to locate the works; and (2) that works turning out not less than 5,250 metric tons per annum will be exempt for eleven years from business and income taxes, and from all forms of prefectural local and municipal taxation, as well as being allowed to import free of duty the machinery &c., required for the works. The figure of 35,000 metric tons is based on the assumption that it is not economical to erect works with a furnace capacity of less than a 100 tons per working day for 350 days, while the figure of 5,250 tons is based on a production of 15 tons per day for the same period, this amount being fixed for the benefit of the smaller concerns. With great industrial activity existing in the country and the shipbuilding boom at its height, the passing of this new law has resulted in the launching of a number of new undertakings. Some of these schemes are financed and planned by important groups, which have been impressed by the large increase in the consumption of iron in Japan, especially during the last few months.

After the war, Great Britain will strive to regain her lost trade, and she will have to compete for that which has already been won by Japanese commercial enterprise. She is entitled to fair success in this struggle and as she has long occupied a position of importance in the shipping trade of the world, and as her seamen are excelled by those of no other nation, she will succeed in regaining her lost position in a great measure. The Germans will also strive to regain what they have lost, but it is by no means certain that they will succeed, for it will be difficult for them to rebuild their fleet. The United States will also have to strive hard if she is to retain what has been gained in the East during the war, for her weak point is the Seaman's Law and shortage in efficient seamen. If this weakness is remedied she can retain the fruit of the past endeavours. The outlook, however, for Japan itself in the after-war struggle for the retention of her shipping gains is not particularly hopeful as she has inflated her merchant fleet too much. It is questionable whether Japan can keep all her ships in full employ. Japanese seamen, however, have a strong point which will be important factor in the post-war competition. They can work at a lower rate than American or Britain seamen. The possibility of having to relinquish their war gains is perhaps the reason why the Japanese shipping companies are declining to receive further bounties from their government. They desire to be quite free and unfettered but the Japanese Government is determined to give the aid. Ignoring all application petitioning the government to stop further shipping bounties, the department of Communication ordered the Nippon Yusen Kaisha, the Toyo Kisen Kaisha and the Osaka Shosen Kaisha, Japan's largest shipping firms, to receive the bounty. Details of the amounts of the bounties and the names of the firms whichf have been ordered to receive it are:

European service:—This line should be maintained by the Nippon Yusen Kaisha semi-monthly with all ships, each of more than 5,500 tons and sailing at 14 knots, making 26 round trips a year, and for which the government is ready to subsidize 1,689,850 yen in 1918, and 1,569,672 yen in 1919.

Puget Sound service.—This line should e operated by the Osaka Shosen Kaisha bi-monthly with 6 ships, each of more than 5,500 tons, sailing more than 14 knots, making 26 round trips a year, and for which the government is willing to give 2,669,925 yen in 1918 and 2,309,187 yen in 1919.

San Francisco service.—This is to be maintained by the Toyo Kisen Kaisha four-weekly with 3 steamers each of 12,500 tons, and sailing more than 18 knots, making 14 round trips a year. Owing to the fact that this line competes with more than one other foreign line, the government has refrained from announcing the exact amount of subsidy.

Pacific South American service.—The line must be operated by the Toyo Kisen Kaisha bi-monthly with 3 ships, each of more than 6,000 tons, sailing faster than 13 knots, making 6 round trips, and for which the government will give annual subsidy of 284,836 yen in 1918 and 269,350 yen in 1919.

Australian service.—This line is to be operated by the Nippon Yusen Kaisha monthly with 3 ships, each of more than 5,000 tons, sailing faster than 15 knots, making 12 round trips a year, and for which the government will give 169,470 yen in 1918, and 188,497 yen in 1919.

Turning to the industrial development in Japan the installation of plant of all kinds is continually increasing for both machine-making and manufacturing. War conditions in Europe have given the Japanese business men a fine opportunity in metallurgical and shipbuildinng trades. The total number of mills now manufacturing machinery is 1,180—that is mills employing men of 18 years and over—and these probably do not include textile factories mostly staffed by young females. Machinery shops are now prosperous, and they include makers of spinning and weaving plants. There are 1,951 dyeing and weaving establishments in Osaka district, an increase of 288 over 1916, many of them being small concerns, probably employing only a few hands. Nevertheless, the number of workmen in May, 1917, was 78,827 an increase of 3,830 over May 1916. All other kinds of industry show an increase in mills and work people, which seems to indicate that Japan is performing a share of the war work, including munitions. The cotton mills appear to have had a good year. The balance sheets of two spinning companies have been recently published—the Toyo and Amagasaki companies; the former declared a dividend of 40 per cent. in addition to which both concerns placed large sums to reserve and carried forward an important proportion of the total profits. Accounts of industrial activity and advancement all round indicates that Japan is forging ahead in manufacture while Europe is fighting

Chemical Industry

Another remarkable feature of the economic development of Japan is her extraordinary progress in the chemical industry. At the commencement of the war this industry was still in its fancy, yet to-day Japan exports chemical products for the supply of which she was but three years ago entirely dependent upon outside sources. Whether when the war is over Japan will have secured the foundation of this new industry sufficiently well to maintain it, is another matter. Without an adequately protective tariff it is doubtful whether she will, for, in spite of the availability of some of the raw materials in Japan itself or in the countries near at hand, in spite of the great advantages she posses in cheap labor, and the access she enjoys to cheap motive force by reason of her abundance of waterfalls, the chemical industry of Europe and the United States has gained such a footing in all parts of the world, that a new competitor is bound to have a very hard fight for existence when times are normal again. Nevertheless, the power of her industriousness and her genius, will secure her a place among the chemical producing nations, but it may take time as the chemical industry in Japan is an emergency one. Unable to obtain adequate supplies of chemicals from the ordinary sources of peace time, she has produced her own, and in some cases produced sufficient for export purposes. Great Britain can regard without envy the advent of Japan as a new competitor, but Germany will be the largest loser through the development of the Japanese dyestuffs industry. For many years to come Japan is bound to be a large customer of Great Britain for soda ash and caustic soda; in fact as she develops her other industries her need for these alkalies will become greater and, lacking what we possess, abundant supplies of cheap salt, it is at least doubtful whether Japan will be able in the near future to produce sufficient alkali to satisfy her home requirements. The production of soda was started in Tokyo, Osaka, and Yamaguchi Prefectures some thirty years ago, but, owing to the comparatively high cost of salt development has been slow. At the present time soda is being produced by an old system by the Canto Sanso Kaisha, of Tokyo Prefecture, and the Onoda Works, of Yamaguchi Prefecture. Accordinng to Dr. Toyokichi Tamatsu, one of Japan's distinguished industrial chemists, means have been studied for supplying industrial salt at a low cost, and, in addition, for working the ammonia and electro systems of soda making. Those engaged in Japan's progressive soap and glass industries—to mention only two of the commercial uses of alkali—would hardly consent without protest to a heavy protective duty on soda ash and caustic soda.

Turning to another branch of chemical industry, Japan has made wonderful progress in the production of Phosphorous; before the war Japan imported all the phosphorus she required for her match industry from England, France, and Germany. But now The Chemical Industry Company and the Fuji Electro-Chemical Company are manufacturing phosphorus from phosphite imported from the southern Pacific Islands, and some idea of the size of the output can be obtained from her huge export trade in matches. During 1915-16 she exported 14¼ million gross of matches, to India alone—this in spite of an Indian custom duty of 7½ per cent. Whether when English phosphorus again becomes available for export and prices become normal Japanese phosphorus will be the cheapest product for the match-makers to us remains to be seen. But, judging from the price at which Japan has been able to sell to India matches made from Japanese phosphorus, it would seem that the cost of its production from phosphorite is relatively low. Another match making chemical, potassium chloride, is being produced on an extensive scale in Japan at Aidzu, where the water power of Lake Inaswashire is utilized, and at various other places. It is also estimated that 10,000 tons can be made annually from seaweeds gathered on the coasts of Hokkaido, Karafuto, Chiba, and Kanagawa districts.

Japan is also making sulphate of ammonia from bye-products of the gas and coke factories and from nitrogenous lime The production of acetate of lime by the Japan Acetate Acid Company has also increased, and it seems probable that America will lose a good customer for the acetate. The Tokyo Gas Company is making carbolic acid, and the Japanese Dyestuffs Company has laid plans for manufacturing it from benzole. The yearly production of sulphuric acid in Japan is little short of three quarters of a million tons, and it is intended to establish a plant for the production of this acid by the contact process.

As to the dyestuffs industry, it is common knowledge that the Japan Dyestuffs Manufacturing Company has been founded and is backed by the government. Before the war Japan imported from Germany coal-tar colors to the value of something approaching a million pounds sterling, and, although the Japanese industry is still in its infancy, it is quite clear that Japan does not intend to go on paying such a tribute to Germany.

And in the Departments of Commerce and industry Japan is making rapid progress and there is little doubt that now her business men have awakened to the possibilities of trade and commerce her industries of all kinds will grow to a very great extent. There is no doubt Japan will make herself quite independent of Germany and German manufactures, and perhaps all the other Allied nations will follow her example.

Incorporation has been granted to the Campbell, Howard Machine Co. Ltd. The incorporators being residents of Montreal. The purposes of the company are as follows: To carry on the business of manufacturers of iron and woodworking tools and machinery, iron founders, steel makers, brass founders, metal workers, millwrights, machinists, etc. The capital stock of the company is placed at $650,000 and the head office will be at Sherbrooke, Que.

Heating and Ventilation Are Very Important

When a Factory is Being Constructed All These Details Should be Attended to—It is Sometimes Possible to Make Changes in Plans to Secure the Best Results

THE SECOND OF A SERIES BY M. H. POTTER.

THERE are many systems of heating buildings, among which are: By means of exhaust or live steam in lines of pipe arranged overhead or along the walls, by coils or radiators, by hot water utilized in a similar way; by air furnaces, or by contact with pipes through steam flows. All these systems have their good and bad features, both as to their warming qualities and their cost, as well as the expense of operating them. The hundreds of feet of steam pipes, with their numerous fittings, furnish at each joint opportunities for leaks, and special arrangements must be made to keep them clear of water. The distance from the boiler to the further end of long systems frequently requires much time to force the steam through to these points to warm the rooms so that they will be endurable to workmen.

The hot water system works slowly and the temperature of the surrounding air rises gradually, so that the hour for beginning work in the morning must be anticipated by such a length of time as to be a serious drawback to complete success. The hot-air furnace gives air from which much of the moisture is evaporated and which is therefore unwholesome, aside from the fine dust so often brought along with it. In all these systems heating is the only end gained, ventilation being left largely to chance.

The ideal system of warming and ventilation would seem to be that in which fresh air, warmed by steam heat, is distributed by a suitable mechanical progress, as evenly as possible to every part of the building, and one in which this can be done in the shortest time (as in most shops heat is not maintained during the night except at sufficient temperature to prevent freezing of water pipes, etc.), and in which cold air may be readily introduced whenever needed.

This seems to be best accomplished by drawing fresh air from without the building, passing it through a heating apparatus consisting of an iron case containing a large number of steam pipes, and by means of a fan and suitable pipes, distributing this warmed air to every part of the building by numerous outlets. The whole should be controlled by proper dampers, by which a due proportion of warm and cold air may be furnished as needed, so that proper ventilation as well as warming may always be maintained.

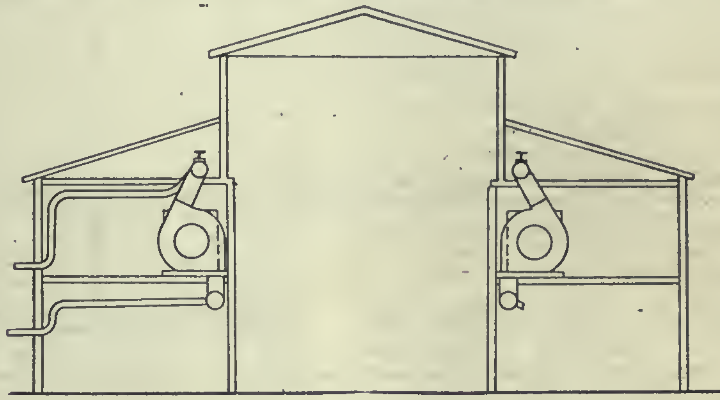


FIG. 4—CROSS SECTION OF FOUNDRY HEATING SYSTEM.

In the warming of such large buildings as those under consideration it is not necessary to draw cold air from the outside atmosphere to any great extent. The number of cubic feet of air contained in the building is largely in excess of that required for each person, and, cold air comes in through frequently opening large doors, while the swinging windows at the roof may be opened when necessary to permit the vitiated air to pass out, thus providing ample ventilation.

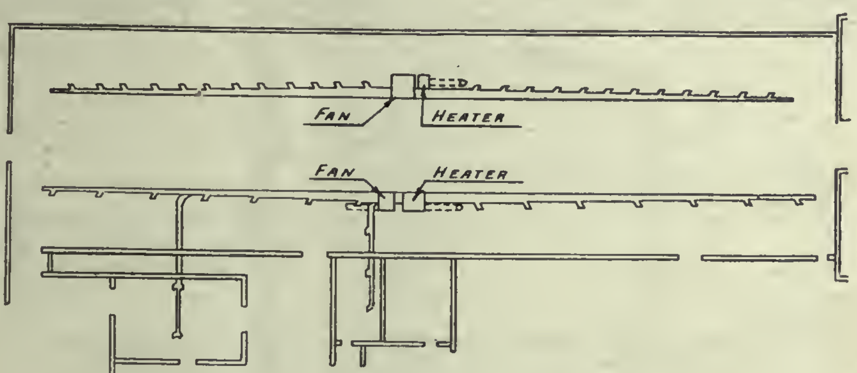


FIG. 3—PLAN LAYOUT OF FOUNDRY HEATING SYSTEM.

The heating apparatus should be located near the center of the building so as to distribute the warm air to all points with the least amount of piping. Openings should be so arranged as to be not over 30 feet apart, and to open toward the outer walls of the building. They should not be less than 8 feet above the floor, nor less than 5 inches diameter, and usually incline downward at an angle of about 10 degrees. The aggregate area of openings should exceed the area of the main pipe at the fan by about 25 per cent.

About 6 square inches area of openings should be allowed to every thousand cubic feet of space contained in the building or room, where the building is so divided. The velocity of air should not be less than 1,500 feet per minute, and a sufficient quantity should be supplied to change the air about every 25 minutes.

The pipes are preferably circular, as less material is required to make them of this form, circular pipes are stronger, and there is less friction of air in passing through them. However, square or rectangular pipes are sometimes necessary on account of lack of space. When such is the case this area of cross-section must be increased accordingly so as to overcome undue friction. Galvanized iron is the most desirable material for these pipes and is almost universally used where pipes separate from the building construction are used. In factory buildings having several floors, proper flues and air ducts are arranged in the walls, and in the basement, where the heating apparatus is usually located.

Machine Shop Arrangement

Fig. 1 shows the plan of arrangement of the heating system of the machine shop and Fig. 2 a cross-section of the same.

The heating apparatus consists of a rectangular iron case containing a large number of steam pipes of practically U-shaped form, inverted and connected to a cast iron base in such a manner that one leg of the pipe connects with the space through which the steam is admitted and the other leg connects with the space from which the drip is taken. These pipes should be located as close to each other as practicable, the rows of pipes being set staggering so as to break up the currents of air. The casing which surrounds them and connects with the inlet of the fan should also be formed as closely to the pipes as may be, in order that all air which is drawn through may come into close contact with the heating surfaces of the pipes.

It is customary to allow one foot of 1-inch pipe, or its equivalent, to each 100 to 150 cubic feet of contents of the building to be heated, when all the air is taken from out-of-doors. In the case under consideration, with one-half or more of the air from within the building the higher figure would probably be ample. At the end opposite the fan are located dampers for regulating the amount of air supply. One of these may be connected with a cold air duct from out-of-doors where necessary.

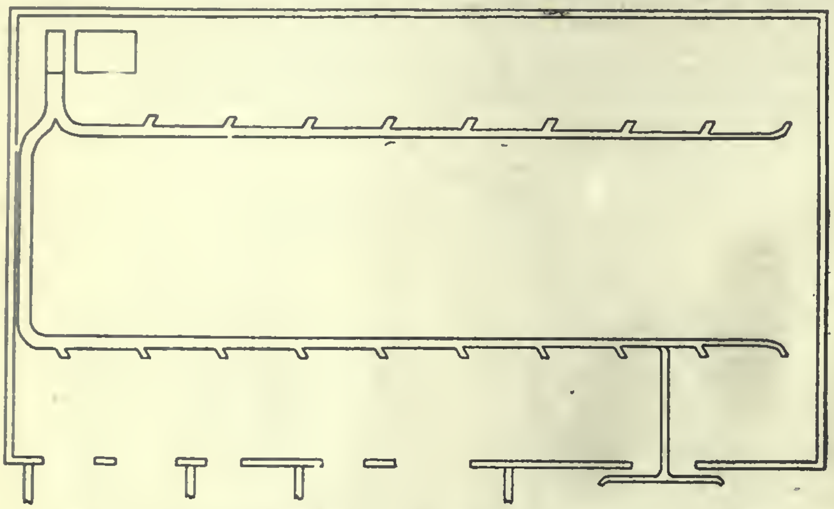


FIG. 1—PLAN ARRANGEMENT OF MACHINE SHOP HEATING SYSTEM.

Referring to Figs. 1 and 2 the location of the apparatus is seen to be in the gallery floor, near the centre of the building. The fan has two discharge openings, one downward for warming the side wings of the first floor, and one at an upward angle for the same service on the gallery floor. The returning currents of air flow into the central portion of the building and warm that portion in their upward course.

Two sets of apparatus are used, for the reason that the traveling crane over the centre portion of the shop prevents convenient connections between the two sides; and further, that the space to be heated is so large that the questions of convenience and economy are best met by this arrangement.

The apparatus on the side nearest the power house will require a fan with a wheel say 100 inches diameter by 52 inches wide, and running at about 185 revolutions per minute. This will supply from its downward opening the pipes for the main floor, including that leading to the carpenter shop and to the wash room on the first floor, and from its upward opening it supplies the pipes from the gallery floor, including one for the wash room on the second floor.

The apparatus on the opposite side of the shop should have a fan with a wheel say 90 inches diameter by 48 inches wide, running at about 250 revolutions per minute. The pipe connections are similar to the first apparatus, except that there are no long branch pipes to be provided for. Hence, while a 36-inch pipe is necessary for the side toward the power house, in order to warm the carpenter shop and the wash rooms, one of 29 inches diameter will be quite sufficient for the opposite side. It should be said that the dimensions given on the drawings are from actual calculations, taking into consideration all the circumstances of the form and dimensions of the buildings, and they will probably be found correct in practice as well as theory.

The openings for the discharge of warm air into the building are directed toward the outer walls and downward at an inclination of about 10 degrees. This arrangement is clearly showing in the drawings Figs. 1 and 2.

The pipes should be well riveted as they are put up, and securely fastened so that they may not be loosened by any jarring or vibration, either of the buildings or that caused by the pressure of air passing through them.

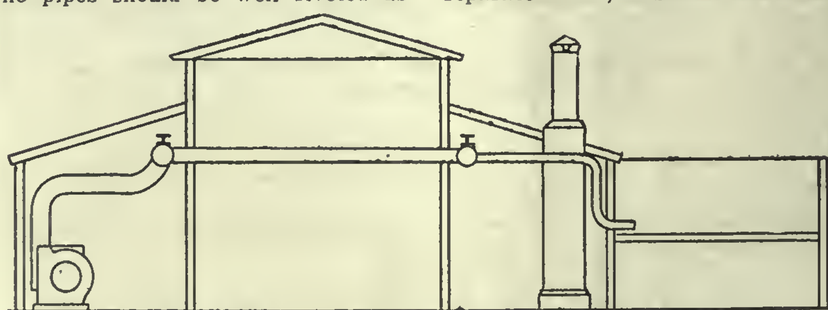


FIG. 2—CROSS SECTION OF PIPING ARRANGEMENT FOR MACHINE SHOP.

The fans may be driven by an electric motor or by an engine attached to each fan, or by belts from the main line of shafting.

Live steam should be used for heating. The large apparatus will probably require a supply pipe of 6 inches in diameter and the smaller one of 5 inches. The apparatus should be so constructed that a section of it may be separately connected for using the exhaust steam from the fan engine. In the same way the exhaust from the main engines of the works may be utilized and thus save a considerable portion of the live steam required.

Heating Layout for Foundry

In arranging for heating the foundry, different conditions are met with. With the exception of the chipping and pickling room heat is required hardly more than half the time, that is, during the forenoon, and perhaps for an hour or more after the dinner hour, as the heat from the cupolas is considerable. The general plan of the system is the same as that employed in the machine shop. The apparatus requires but little room on the floor and consists of a fan having a wheel about 78 inches in diameter and 24 inches wide, running at about 400 revolutions per minute, and will require about six horse-power to drive it.

An arrangement of pipes can be made whereby the chipping and pickling room could be warmed independently of the foundry proper, but it would probably not be necessary.

Figs. 3 and 4 show the arrangement of the foundry system of heating, with diameters of the pipes and openings. It will be preferable to run this fan by an electric motor, and since these fan blowers for heating purposes are now made with simple and compact engines attached to them, which require very little attention, aside from starting, stopping, and oiling, they are very convenient in such situations.

It is always important to have the heater as near the space to be warmed as possible.

System for Other Units

The office building, including the pattern shop, drawing room, and tool department, is heated by an apparatus located in the tool room and forming a separate system. It may be driven by a separate motor, or belted from the shaft which drives the machines in the tool room. The latter plan is probably the best, since the power is convenient, and the first cost may be lessened without sacrificing any desirable feature in another direction.

The main pipe passing through over the driveway must be amply protected, the space being filled with sawdust or similar material, and this again is covered by another box large enough to leave an air space of about three inches between the two, on all sides.

For the office rooms the pipes may be of rectangular form, concealed by suitable architectural finish of the ceiling, in which lateral openings for registers may be made. Or, proper air ducts may be formed in the side walls and the registers placed at suitable intervals. Or the pipes may be carried around inside the walls, close to the ceilings, and registers located in the same manner.

There may be for this system the double-duct arrangement. That is, two sets of pipes or ducts, one carrying cold and one warm air, the registers being so arranged that they will furnish one

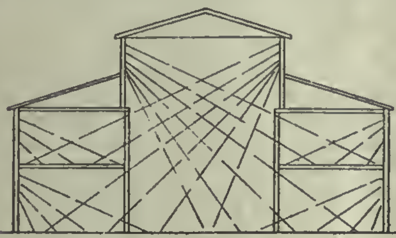


FIG. 5—CROSS SECTION SHOWING LIGHTING ARRANGEMENT.

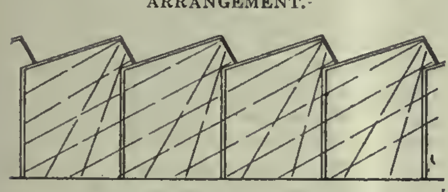


FIG. 6—CROSS SECTION OF SAW-TOOTH LIGHTING SYSTEM.

or the other, or a mixture of both, by means of what is technically known as a "mixing damper."

In offices and rooms of moderate size which are heated by warm air being forced into them near the ceiling, it is usual to provide means of escape for the air as it cools and descends to the floor, through grated openings placed two or three feet from the floor, and connected with flues or ducts leading to the roof. But in offices where doors are frequently opened this does not seem to be necessary, the problem of ventilation being of small consequence compared to that of heating.

The forge shop and various other buildings require no special arrangements of heating.

Suitable Temperatures

The question of proper temperature of shops where men are at active work should be considered as quite different from providing for heating a factory where the work is usually much lighter, the number of employees per hundred feet of floor space much greater, and frequently a large proportion of them females.

In a machine shop devoted to a medium class of work, a temperature of about 60 degrees will be found comfortable. The temperature in the storeroom, tool room and pattern shop will need to be about 65 degrees, and the drawing room and offices, between this and 70 degrees. Unless the ventilation is very carefully attended to, there is more danger in having these latter rooms too warm than not warm enough, and any system of heating which does not recognize the importance of good and thorough ventilation is radically wrong in both theory and practice.

Natural Lighting

For properly lighting a shop during the daytime, many forms and portions of windows have been devised, from those of small area and diminutive lights of glass, to those very high and narrow, those broad and low; those of large area placed far apart; those of much less area placed near together; those covering almost the entire wall with glass area; those placed vertical and those in an inclined position; those placed as skylights in the roof; and those placed in the ventilating space at the top or ridge of the roof.

Again, as to the kind and quality of glass used. Some prefer the ordinary plain glass, admitting a flood of light, regulating it by means of shades or curtains. Others use the same glass, stippling the surface with white zinc thinned with spirits of turpentine to relieve the eyes of the glaring light. Rough glass and ground glass is often used.

What is called ribbed glass with the ribs running in a horizontal direction, is probably better than either. In viewing these various methods of construction it may be said that broad and low windows in the side walls will light the bench at the wall and perhaps two rows of machines, where the centre of the room receives little or no illumination. This condition is sometimes sought to be remedied by the use of skylights in the roof.

Windows placed too high in the side walls will light the centre of the room but leave the benches around the walls in the shadows of the high window sills. Therefore it is proper to so locate the window sills as to afford proper light at the bench vises; then to continue the window well up to the ceiling in order that the whole room may receive, as nearly as may be, an equal quality of light.

Fig. 5 shows a cross-section through the machine shop, and gives the floor surfaces illuminated by parallel beams of light at various angles. It should be understood that in all these cases light is not confined to these surfaces, since it is always more or less strongly diffused over a much larger space. These diagrams are only intended to show the relative amount of illumination.

Fig. 6 is a cross-section of the newer form of saw-tooth roof construction. All illustrates the largely increased amount of surface lighted up by this method, which is now generally regarded as the best practice for lighting large areas in one-storey shops.

The width of the windows and the distance apart is a matter of great difference of opinion.

Artificial Lighting

Let us now consider the question of artificial light. To properly provide for sufficient lighting, we must select some one of the many systems in use, and the one which seems best adapted to the conditions of the case. To provide an ample, proper, safe, and thorough system of illumination for buildings in which a large number of persons are obliged to labor for so many hours each year by its aid would seem to be a matter that need not be argued or advocated. Yet there are many shops at the present time so constructed that some kind of an artificial light is needed all through the day, and in some nearly all seasons of the year, and this condition prevails over a considerable part of the working period.

In the application of electric light in manufacturing operations we have the choice of the arc lamp and the incandescent lamp. Both have their objections as well as their merits. The arc lamp, being much more powerful and projecting its rays a much greater distance than the incandescent lamp, is well adapted to illuminating large areas, where there are comparatively few objections. In confined situations, or where there are many obstructions, it produces disagreeable shadows, and its glaring brilliancy is hurtful to the eyesight of the workmen.

Translucent globes or shades may be used, of course, but these devices necessarily reduce the illuminating power of the lamp.

The incandescent lamp gives a much softer and more agreeable light to the eyes of the workmen, who may work many hours by its aid with less discomfort than by almost any other light. It is also much more portable than the arc lamp, since it may be provided with flexible conducting cords of any convenient length, and hung up or held in the hand in the most desirable position.

In the machine shop the clear space needed for the travelling crane precludes the suspending of arc lamps through this central portion, but they may be placed between and a little inside of the line of the columns. From the character of the machines employed and the work done in the galleries the incandescent lamp will be the most suitable. There should be at least one to each machine and in the case of long lathes one to every ten or twelve feet of bed.

The large open space of the foundry may well be provided with arc lamps.

The core room, wash rooms, offices, etc., will require incandescent lamps. The forge shops will be best served by two arc lights in the main part, and by incandescent lamps in the foreman's office.

The entire front building, including the offices, tool rooms, pattern shop, pattern storage loft, drawing room etc., should be lighted by incandescent lamps, those in each room being arranged to suit the peculiar conditions in each case, as to the kind of shades and reflectors employed.

AERO-PROPELLER SHAPING MACHINE

Aeroplane propellers, as is well known, are usually built up of laminations of wood of equal thickness glued and dowelled together. The built-up body is subsequently worked to the required shape very frequently by a purely hand-tool process. This method of finishing the body naturally calls for the exercise of highly skilled workmanship and is essentially slow. While the aero-propeller is geometrically a very complicated body, it is not impossible to reproduce its form by mechanical means with the requisite degree of accuracy. Much attention has been devoted to this matter, and as a result there are now obtainable, or in use, several forms of propeller-shaping machines.

PROPELLER SHAPING MACHINE. FRONT VIEW.

One of the most recent British designs of such a machine is illustrated in the accompanying engravings, for which we are indebted to the "Engineer." This appliance is manufactured by A. Ransome & Co., Limited, of Newark-on-Trent, who have brought it out in conjunction with Mr. J. J. Kerr, of Lincoln. The design is patented. Like all other machines of its class, it works by copying the profile of a model blade. So far as we know no machine has been designed to generate the form of an aero-propeller, the reason being probably the difficulty of dealing with the varying convex curvature of the forward face.

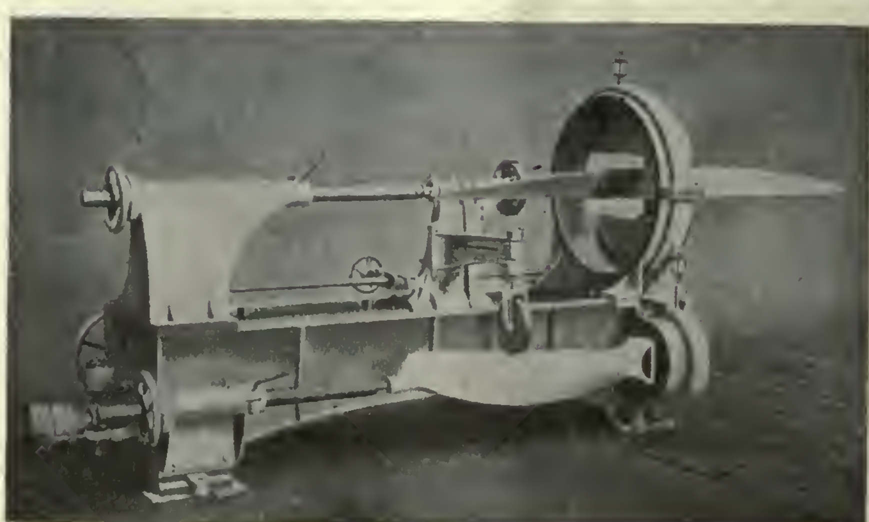
In the Ransome-Kerr machine the model propeller blade and the work are rotated at the same rate on parallel axes, the angular position of the model on its axis being 90 deg. in advance of that of the work. A travelling carriage provided with a rotating circular cutter head is fed slowly along a screwed shaft fixed within the frame of the machine. A copying roller bears against the surface of the model and swings the carriage about the screwed shaft as axis. An angle of 90 deg. being included between the lines joining the centre of the screwed shaft with the centres of the cutter and roller, the profile of the model is thus reproduced facsimile on the work as the carriage is fed along the screwed shaft.

The propeller being worked to shape is held by a bolt passing through its boss and two flanges formed on a circular cast iron driving head rotating within a casing which is bolted to the machine bed. The tip of the blade actually being operated upon is supported on a back centre at the end of the tailstock spindle. This spindle is of considerable length, to enable propellers of various diameters to be accommodated. The model blade is similarly supported between a driving head and a tailstock fixed to the side of the machine frame. The two driving heads are driven at equal rates through cut gearing from a belt-driven countershaft lying within the bed of the machine directly below the screwed shaft for the cutter carriage.

The cutter carriage is formed with a long bearing to receive the fixed screwed shaft. At its upper end it has two split bearings for the cutter spindle. Between these bearings the spindle carries a pulley from which a driving belt passes down to a sliding pulley on the countershaft. As the carriage pivots about the screwed shaft and not about the countershaft, this method of driving the cutter spindle might cause the countershaft to show a tendency to bind in its bearings. These bearings, however, as clearly shown in one of the views, are mounted so as to be able to turn about two axes and thus to accommodate any deflection of the countershaft produced by the pull of the cutter spindle belt. Feed motion is communicated to the cutter carriage from a split nut which, at will, can be engaged with the fixed screwed shaft. This split nut is rotated by gearing from the cutter spindle, so that should the cutter cease to revolve, as by the belt slipping off the sliding pulley on the countershaft, the feed motion will also stop simultaneously, and the work will not be damaged. In the transmission between the cutter spindle and the split nut a clutch is placed. This clutch is used to start and stop the feed, and is automatically operated to stop the feed when the cutter reaches the propeller hub. The cam operating the clutch handle for the latter purpose is carried adjustably on a bar running between the head and tailstocks. This bar also serves as an abutment against which a block, sliding in a link pivoted to the carriage, can be screwed so as to hold the cutter away from the work while the carriage is being traversed back to its starting point. The return movement of the carriage is effected by means of a hand wheel at the tailstock end of the bed.

Provision is made whereby the work may be brought to its finished size by a series of traverses or whereby the work may be turned out larger by multiples of half a milimetre than the model. Normally, the distances between the centre of the screwed shaft and the centres of the cutter and the copying roller are equal. The copying roller is, however, carried at the end of a screwed spindle having a handle fitted with a spring plunger which engages with the holes of a quadrant on the body of the carriage. By these means the length of the copying roller arm can be adjusted to give the cut required.

The machine can deal as readily with four-bladed as with two-bladed propellers, the two additional blades in the former case simply swinging clear of the driving head. The finish of the work turned out, and in particular of the knife edges of the blades is, we are informed, in every way satisfactory, the surfaces subsequently requiring only to be touched up with sand paper.



PROPELLER SHAPING MACHINE. REAR VIEW, SHOWING FORM.

Theory and Application of Sectional Views

Every Mechanic Should Know How to Make and Interpret Mechanical Drawings and Sketches of the Simple Type—Practical Course Prepared For Younger Men and Newcomers in Industry

Fifth of Series of Articles By TERRELL CROFT

SEEK contrasts because contrasts render a drawing more pleasing to the eye and also make it more easily understood. Where bold lines are required for outlines, make them sufficiently bold so that they will be conspicuous by virtue of contrast, and so that they will indicate the contour of the object without minute examination. On the other hand, when fine lines, that is, light lines, are required, make them fine so that there can be no possibility of mistaking their intent.

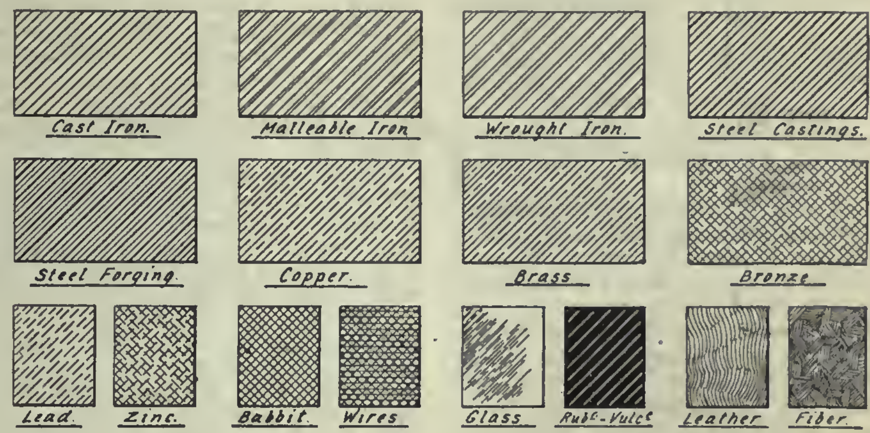


FIG. 5—SECTIONAL LINES TO DISTINGUISH DIFFERENT MATERIALS.

The reason that sectional views are used is that it often transpires that it is inconvenient, difficult, or even impossible to show the interior construction of an object by dotted lines drawn in on the exterior views. Furthermore, as has previously been suggested, it is often possible to show with one sectional view the detailed construction of an object which would, if plan, side, and front views were used for its delineation, involve the preparation of a complicated and expensive drawing. Just how these sectional views may be utilized will become apparent to the reader as he proceeds.

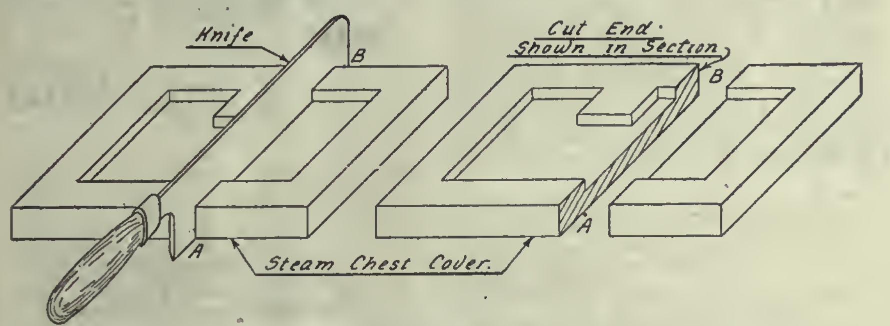


FIG. 1—CUTTING A SECTION FROM STEAM CHEST COVER
FIG. 2—PERSPECTIVE VIEW OF ABOVE AFTER CUTTING.

A sectional view of an object is drawn as if a portion of it were cut away. To understand thoroughly the meaning of the preceding sentence, let us make a sectional view of the steam chest cover which has been the subject of discussion in the foregoing articles. Assume that the steam chest cover is cut across with an imaginary knife as shown in Fig. 1. Then, if the two component parts were separated they would appear as delineated in the perspective view of Fig. 2. Looking at the end surface AB we would see the cut end or a sectional view through the casting. When plotted into an orthographic working drawing, the sectional view would then obviously be as shown at "Section AB" in Fig. 3. In actual practice, instead of thinking of the object as being cut through with a knife, it is usually more convenient to assume that it is cut by a plane, as diagrammed in Fig. 4. Such a plane may be called a "cutting plane."

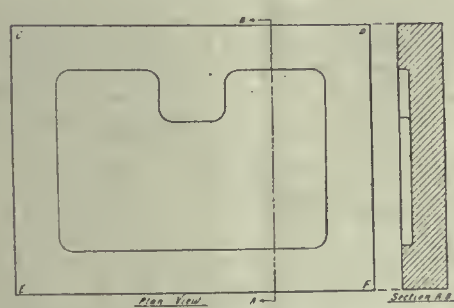


FIG. 3—WORKING DRAWING (WITHOUT DIMENSIONS) SHOWING SECTIONAL VIEW.

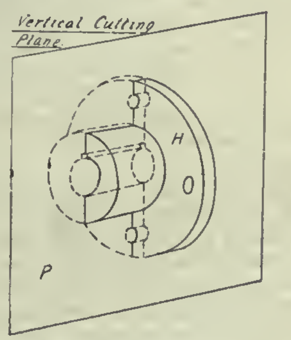


FIG. 4—SHOWING CUTTING PLANE FOR HALF SECTION.

It is always desirable to indicate the location of the cutting plane. For example, the cutting plane in Fig. 3 is located at AB, hence the words "Section AB," under the sectional view, indicate that this view shows the appearance looking at the end of the object when it is cut through on the plane AB. Note that a cutting plane or section line (for example AB in Fig. 3) consists of a series of dashes with two dots between each pair of adjacent dashes. A line thus made, with two dots and a dash, should be reserved to indicate only cutting planes and should be used for no other purpose. Sometimes the letters and the line indicating the location of the cutting plane are omitted from the drawing. Where this condition is encountered it may ordinarily be assumed that the cutting plane passes through the center—either the longitudinal center line or the vertical center line—of the object.

The exposed cut surface in a sectional view is cross-hatched; that is, section lines are used to indicate that the surface on which they are drawn represents a cut surface. Different arrangements and intensities of cross-hatching lines are used in practice to indicate different materials. Fig. 5 shows the symbols which are ordinarily thus employed in practice. It should be noted that there is no standard or universally-adopted set of cross-hatching symbols. Efforts have been made to have certain symbols standardized, but they have not been very successful. In view of this situation it is always desirable, unless there can be no question as to the material which a certain kind of cross-hatching on a drawing represents, to specify on the sheet just what material it does indicate. Cast iron is practically always indicated by light lines uniformly spaced. Wrought iron is shown by pairs of fine lines (Fig. 5) with a wide space between each pair. Steel is practically always indicated with alternate light and heavy lines. Fig. 5A, showing a longitudinal section of babbitt boxes of two types,

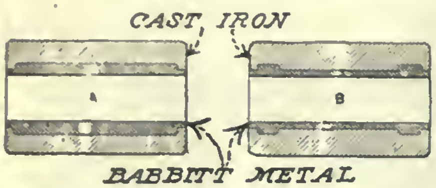
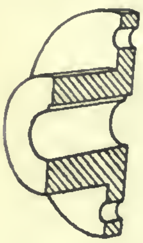


FIG. 5A—TWO METHODS OF BABBITTING A BEARING.

shows how the ordinarily-used babbitt symbol contrasts with that employed for cast iron. Incidentally note that the construction of B (Fig. 5A) is more economical of babbitt than that of A, and should therefore be employed during these times when bearing metals are so expensive.

Partial Sections

In a drawing where sectional views are used, no part is shown cut away from the main view; that is, the main view is shown complete with the location of the



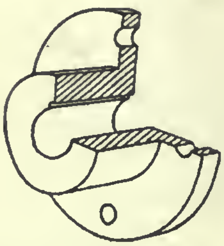


FIG. 6—HALF SECTION REMOVED. FIG. 9—QUARTER SECTION REMOVED.

cutting plane indicated on it, and only in the sectional view is a part of the object assumed to be cut away and discarded. For example, in Fig. 3 the complete steam chest cover is is shown in the plan view CDEF, and lt is only in Section AB that it is assumed that the portion BDFA is removed.

A half section view is one for which it is assumed that the object is divided by the cutting plane, which passes through an axis of symmetry, into two similar parts. Thus, in the perspective view of Fig. 4 the cutting plane is shown passing through the axis of the flange coupling. With the cutting plane and the portion H taken away, the half of the flange coupling which remains would

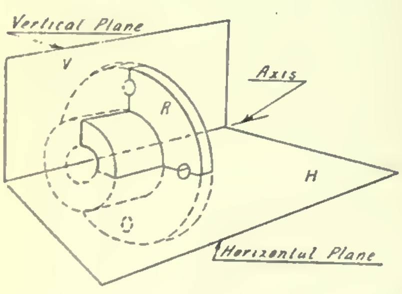


FIG. 7 FLANGE COUPLING SHOWING HALF SECTION.

appear as shown in Fig. 6: If this coupling is rendered in orthographic projection with the sectional view at the right of the end view, it will appear as reproduced in Fig. 7.

A quarter section is one wherein two cutting planes located at right angles to one another, and intersecting along an axis of symmetry, cut the object. Fig. 8 illustrates this definition as it applies to the flange coupling. With the cutting planes and the portion R removed, the cut coupling would be as diagrammed in Fig. 9. Then the corresponding working drawing would be arranged as suggested in Fig. 10.

Partial sections may be employed to advantage in many instances. A partial section is one wherefor it is assumed that some part of the object is cut away, so as to expose other parts within. The cutting plane with this sort of view need not be along any axis, nor need it have any particular relation to the symmetry of things in general. The draftsman merely cuts away the parts which interfere with a good view of the portions which he wishes to expose, and then completes his drawing on that basis. In Fig. 11 is reproduced a broken or partial sectional view of a clutch pulley, wherein a part of the pulley rim and of the cylinder C are, so it is assumed, cut away to show the parts inside. A splendid example of a broken section view is that of Fig. 12, wherein a part of the pipe is cut away, to disclose objects inside of it.

The cutting plane need not be a continuous plane. If it will be of assistance in showing the construction of the object under consideration, the draftsman may assume that he is cutting the object along any regular or irregular course. For example, it is desired to show the

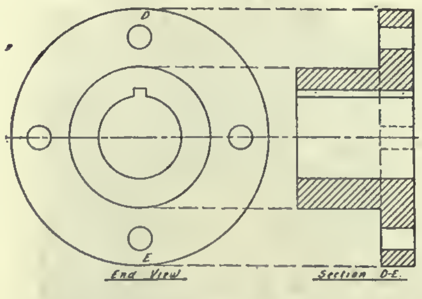


FIG. 8—SHOWING CUTTING PLANE OF QUARTER SECTION.

construction of the casting of Fig. 13 with two views, a plan view and a sectional view. To do this most effectively the draftsman must assume that his cutting plane follows the lines ABCD in Fig. 14. Fig. 15 gives a perspective illustration showing the position of the assumed cutting plane. The resulting sectional views are completed in the lower cutting plane. The resulting sectional views are completed in the lower part of Fig. 14.

ELECTRICAL PLANT IN STEEL WORKS

The uses to which electricity can be put for the driving of steel works plants are well known. says a correspondent in the Engineering Supplement of the "London Times," and it is not here proposed to seek new converts to electrification. But what is wanted to promote the most successful application of elec-

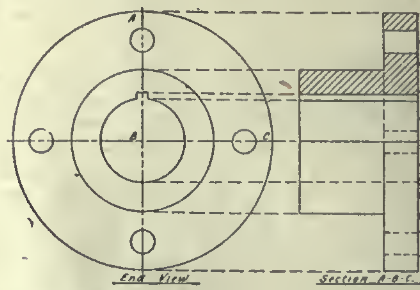


FIG. 10—FLANGE COUPLING SHOWING QUARTER SECTION.

tricity in steel works is a better and more thorough understanding of the conditions prevailing and their bearing upon the design, construction, and installation of the various plant details.

It is futile for the average electrical

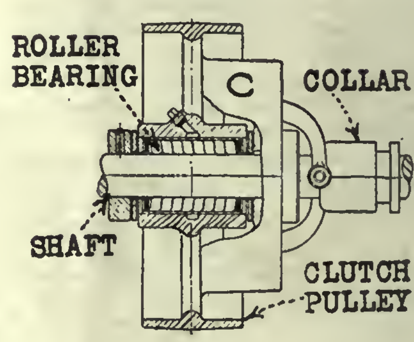


FIG. 21—ROLLER BEARING IN HANGER SHOWING COMPLETE CONSTRUCTION.

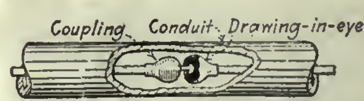


FIG. 12—BROKEN SECTION SHOWING PARTS WITHIN.

engineer who has never studied steel works conditions to attempt to design or issue specifications for plant to be used therein. Failure is certain. On the other hand it is of the highest importance that the steel works engineer in deciding upon the quotations for a particular piece of plant should proceed intelligently and make absolutely sure—first, that what he is asking is the proper type for steel works use; secondly, that he is being offered such plant by the manufacturer; and thirdly, that the details of the plant are such as to assure successful working under the stringent conditions imposed by steel works practice.

Steel Works Operations

To recount briefly the scheme of operations in a modern steel works—the scrap and pig arrive in trucks and are unloaded by magnet cranes either into the stockyard or into the charging boxes. In the former case there is the additional operation of removing from stock as desired and transporting to the charging boxes. The railway siding that brings in the trucks runs parallel to the line of furnaces, and between the railway and the furnace mouths run one or more charging cranes which transfer the charging boxes to the furnaces, upset them, and return the empty boxes to be refilled. The ingots, after being cast, are transported to the rolling mills, where they are reduced to the various sections required. From the start there is an atmosphere of incessant activity. The plant is at work day and night, and the machinery is in many instances running continually.

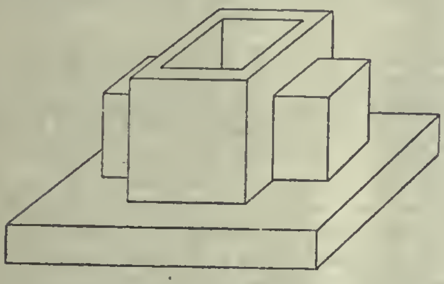


FIG. 13—PERSPECTIVE VIEW OF CAST IRON BLOCK.

The electrically-operated charging machine which conveys the charging boxes has as many as five controllers, all operated by one man. He has to run the machine up and down the line of furnaces, push out the arm of the machine horizontally to engage the charging boxes, give it a vertical lift, slew the machine round through 180°, adjust the height of the arm to the furnace mouth, push the arm into the furnace, turn it through 180° to empty the contents into the furnace, pull in the arm again, and reverse the process. These operations are not carried out singly, and two controllers at least may be working at one time to give their special motions. By electrical operation the speed of the cycle has been reduced to a very few seconds, and it is scarcely believable how quickly an operator can in so short a time move five controllers through their cycles. But while admiring the celerity with which operations are carried out, the electrical engineer must direct his attention to the extreme robustness which must be a characteristic of the electrical plant in order to enable it to withstand such rapid action.

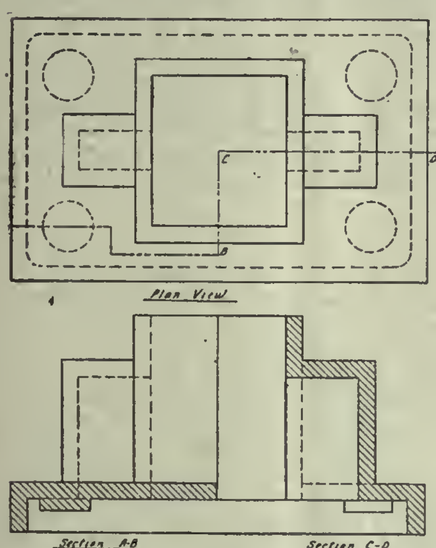


FIG. 14—NON-CONTINUOUS CUTTING PLANE.

Live-Roll Motors

As a further example, take the rolling mills. These are driven by large electric motors of extremely strong construction, and the ingots are conveyed to and from the mill after their various passes by rollers driven by special "live-roll" motors. A good criterion is obtained of the severe duty imposed upon the electrical plant in steel works when it is understood that often these motors are called upon to stop, start, and reverse something like 500 times an hour. If one of them breaks down, putting a train of rolls out of action, the mill may be stopped. It is therefore imperative that in the event of a breakdown the motor should be capable of instant repair. Further, the machine should be readily accessible for inspection.

The line taken in the construction of these motors in the case of the continuous current machine has been to split the shell so that the machine can be opened out in a few minutes and the armature removed for inspection, giving at the same time access to the field coils. In this way the continuous current live-roll motor is similar to the standard traction motor. In the alternating current machine the problem has been more difficult of solution. Success, however, has been achieved in the following way:—The shell has been split as in the continuous current motor, but it acts merely as a container for the machine proper. After removal of the bolts, permitting the top half of the shell to be removed, and also the bearing caps, the bearing bushes are exposed, each provided with an eye-bolt. By applying the crane slings to these two eye-bolts the rotor is lifted out, carrying with it the stator, which is in cylindrical form. After it has been conveyed to a convenient spot the rotor can be slid out of the stator and inspection or repairs proceded with.

There are, of course, numerous live-roll motors about the works and spare parts are provided, the motors being completely interchangeable. As an example of the thoroughness with which the details have been planned, attention may be called to the fact that the motor is designed symmetrically so that if the shaft shears at one end the whole machine can be lifted, turned through 180 deg., and bolted down again in the same place. The other end of the shaft is then available for the attachment of the half-coupling and the motor can be set running again. In this way a thoroughly reliable machine has been constructed. It is worthy of note that before the war these alternating current live-roll motors had not been made in this country, and only within the last few months have British electrical manufacturers tackled the problem with successful results. The same type of machine is now largely being used for other purposes in the steel works.

Enclosure of Motors

The matter of enclosure deserves special attention. Often motors in steel works are exposed to atmospheric conditions, to a considerable amount of dirt and dust, and, it may be, to steam. In inviting quotations for plant it is emperative that the steel works engineers should specify the conditions accurately, and in particular he should inform the manufacturer whether the motor is to be exposed to heat or whether it is to be put in the open air. There are many situations in steel works where high temperatures are encountered. Now, electrical plant is rated upon temperature rise, but if the initial temperature is higher than the standard, the ultimate temperature may reach such a point as to destroy the installation. This has often been a source of trouble in steel works practice. Another fault has been the ordering of machines for outdoor purposes, specifying them as "totally enclosed." But a totally enclosed motor does not necessarily mean that the machine is so constructed that it will not permit the entry of moisture. Where a weather-proof machine is desired, the attention of the manufacturer should be very carefully called to the fact.

Controllers form one of the greatest sources of trouble in steel works plant. By the incessant making and breaking of current heavy stresses are imposed upon the fingers, and to meet the stringent conditions a large number of breaking points must be provided on the drum. Heavy tips to assist in increasing the cooling surface are essential, for the larger the cooling surface the sooner will the arc at break be extinguished. The contact fingers and tips must be renewable, and it is essential that the same facility shall be extended to all other wearing parts.

Lifting Magnets

Perhaps the most striking feature of steel works electrification is the application of electrical lifting magnets, which in the last few years have been installed in surprising numbers. As an example of the economies that can be effected, one magnet has done in a day shift with one man the work that occupied three shifts of eight men in the ordinary scheme of operations. The magnets are sometimes used on jib cranes running about the yard, the crane being equipped with a small steam set generating the exciting current for the lifting magnet, sometimes on transporter cranes either in the stockyard or against the furnaces, but more usually on overhead cranes for loading the charging boxes. The adoption of the lifting magnet has revolutionized the haidling of iron and steel and has led to important increases in production and diminutions in labor costs. Incidentally, many of the cranes are now being operated by women.

In formulating a scheme for the handling of iron and steel it is not less important than in the previously mentioned instances that a thorough acquaintance with the conditions obtaining should be acquired by the engineers of both the purchasers and the manufacturers. Manufacturers who have made a study of the problem have on occasion found themselves in difficulties through the failure of the steel works engineers to realize the strenuous nature of their work. As an example, a magnet crane for a 52-in. magnet should be a 10-ton unit, but steel works engineers have asked, "Why do you propose to instal a 10-ton crane when the gross load will never be more than five tons?" The manufacturer has had in mind the fact that the crane will be working continuously, whereas in the majority of instances where cranes are installed the activity is far less pronounced than in steel works, and he has realized that a 10-ton crane is essential to reliability. Instances are on record where steel works engineers have preferred to purchase lighter cranes on the basis of a closer approximation to the gross load than that offered by the more experienced manufacturer. The result has been dissatisfaction, which, unfortunately, although due to a mistaken selection on the part of the purchaser, has put magnetic handling of materials into disfavor in that particular works.

In the smaller jib cranes, where an electrical generating set and switchboard is installed, the manufacturer sometimes finds a disinclination on the part of the purchaser to pay for proper electrical gear. Such apparatus should be thoroughly weather-proof, and in addition should afford the fullest protection to the operator. Ironclad switchgear, for example, is necessary, whereas in the past the open type of apparatus, being much cheaper, has found its way into use.

There is thus an imperative necessity for the closest co-operation between the manufacturer and the purchaser. No manufacturer should be penalized for offering plant which the purchaser deems too good for the job. Nothing is too good for steel works, and if the purchaser will bear this closely in mind in making his selection and will inquire whether the plant offered is being produced by a manufacturer thoroughly cognizant of the conditions prevailing, he is more likely to obtain plant with that high degree of reliability and strength which is so necessary for steel works drive. In the past it must be admitted that both manufacturer and user have sometimes been guilty of negligence that has led to failure of electrical machinery in steel works. The manufacturer has been ready to take orders without making himself fully conversant with the conditions to be met, while the steel works engineer has rejected offers of thoroughly satisfactory plant for others which had the sole advantage of lower price. Cheeseparing does not pay in steel works plant, and the saving of a few pounds on one machine may be followed by the loss of many thousands through reduction of output.

CANADA'S WORK ON MUNITIONS

On what a gigantic scale are the operations in Canada of the Imperial Munitions Board is indicated in an official statement that the total value of contracts for shells, raw materials and supplies of various kinds up to May 31 last was $1,200,000,000. No less than $1,000,000,000 had been paid out on account of these orders by the board to the same date.

Of this enormous expenditure shells accounted for $664,300,000, the total number of shells produced in Canada to the end of May being 59,390,000. These shells range in calibre from those for the eighteen-pounder and the 4.5 howitzer to the 9.2 howitzer.

Fifteen per cent. of the total expenditures of the British Ministry of Munitions during 1917 was spent in Canada, constituting a very substantial proportion when it is remembered on what an enormous scale is the manufacture of munitions in Great Britain itself, and how heavy has been her outlay in the United States.

Canada's Contribution Striking

In the report issued by the Imperial War Cabinet for 1917, the following statement is made:

"Canada's contribution during the last year has been very striking. Fifteen per cent. of the total expenditure of the Ministry of Munitions in the last six months of the year was incurred in that country. She has manufactured nearly every type of shell from the 18-pounder to the 9.2 inch. In the case of the 18-pounder no less than 55 per cent. of the output of shrapnel shells in the last six months came from Canada, and most of these were complete rounds of ammunition which went direct to France. Canada also contributed 42 per cent. of the total 4.5 shells, 27 per cent. of the 6-inch shells, 20 per cent. of the 60-pounder H.E. shells, 15 per cent. of the 8-inch and 16 per cent. of the 9.2-inch. In addition, Canada has supplied shell forgings, ammunition components, propellants, acetone, T.N.T., aluminum, nickel, airplane parts, agricultural machinery and timber, besides quantities of railway materials including no less than 450 miles of rails torn up from Canadian railways which were shipped direct to France."

450 Factories Engaged

The number of factories engaged in Canada in the production of munitions is 450. Of these 150 factories are occupied in machining the steel shells and assembling component parts which are supplied to them by the board, while 300 factories are producing component parts, which are forwarded to the machine plants to be made into the complete shell.

From 50,000 to 80,000 tons of steel, and from 1,500,000 to 2,000,000 forgings are handled monthly by the Imperial Munitions Board. To July 31 approximately 2,100,000 tons of steel had been received and distributed by the steel department of the board, resulting in the shipment to machining plants or for export of 75,000,000 forgings for shells of sizes ranging from 18-pounder shrapnel to 9.2.

The Imperial Munitions Board has also arranged contracts in Canada on behalf of the United States government, whereby Canadian manufacturers will undertake the machining of approximately 11,000,000 shells and the manufacture of 13,000,000 forgings.

CONSUMPTION OF COMPRESSED AIR

AN easy method of determining the consumption of compressed air by air-driven machines has been recently given by a writer in *Foundry*.

Desiring to secure information regarding the amount of compressed air required per mould by different sizes of foundry vibrators, a small air compressor was used with a shut-off valve located between the compressor and the tank and in the latter the air pressure was raised to 90 pounds. The valve was closed and with a stop watch the time was noted that elapsed for the vibrator to reduce the pressure to 70 pounds. It may be assumed that for all practical purposes this would be equivalent to 80 pounds mean effective pressure, the amount in most general use in foundries. To illustrate in ever figures, it will be assumed that the tank holds exactly ten cubic feet of air and that it takes the vibrator exactly two minutes to reduce the pressure from 90 to 70 pounds. Therefore it is figured that the vibrator used 10 cubic feet of air in two minutes. By actual tests it has been found that the average time the vibrator is working while the moulder is drawing a pattern is about 15 seconds and, therefore, we get eight moulds with 10 feet of air and the vibrator uses 1¼ feet of air per mould. This same principle may be applied to any air-driven tool or moulding machine and it is believed that the results are more nearly representative of actual conditions than theoretical calculations.

To remedy dusty concrete floors, a surface treatment of some kind should be applied to remove the surface skin which does not exceed 1-32 in., or properly to treat it. One way is to grind the surface by hand or power as a terrazzo floor is polished. Other methods are to apply liquid coatings of various kinds. One of the most satisfactory treatments is with boiled linseed oil thinned with petrol to such a consistency that it will penetrate the pores of the surface. If one coat does not cure the trouble generally two will. A second method is to clean the surface thoroughly and then apply a coat of silicate of soda or water glass, 40 deg. Baume, diluted one part to six of water, to seal the surface. Then wash off the excess which opens out the pores again and apply a second coat.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

MACHINING OPERATIONS ON THE 155 M.M. SHELL

By P. Washington

OWING to the difficulty at this time of securing information as to the requirements in connection with the machining of this shell as regards varnishing and painting, etc., this article deals only with the machining in general.

However, it will give one a good idea of the type and general requirements. This shell can readily be kept within the required weight limits, it being obvious as when to take the weight. If a few shells, say, six, are machined first and accurate weight taken before and after each operation, this data will furnish all the information required.

Due to the lack of experienced and first-class operators, and inasmuch as these shells are readily handled, it is advisable to make each operation as simple as possible. Of course, the available machine tool equipment must be taken into consideration.

In preparing to manufacture this shell, the article entitled "Notes Regarding Preparatory Work in Shell Production," which appeared on page 51 of the January 17th issue of CANADIAN MACHINERY, will be found useful.

Cut Off Open End

1st operation (see Fig. 1).—Engine lathe or special cut-off machine. Two cut-off tools set opposite each other, the shell being held in a plain barrel chuck by means of four set screws. Gauging—Gauge depth of bore to make certain that shell will clean up on the base later on. (A definite distance should be agreed upon, and any forging below this limit should be rejected.) Gauge length over all and centre punch before this operation. Check same after this operation.

Centre Closed End

2nd operation (see Fig. 2).—Engine lathe with expanding mandrel having two sets of jaws—one set to grip shell at closed end and the other just forward of the open end. A special drill with no body clearance and a 60-degree point is used. The special fixture consists of a drill spindle, with ratch and pinion mounted in a casting, having a "V" slide to enable the operator to slide the fixture to the rear when placing or removing shells.

Rough Turn Body

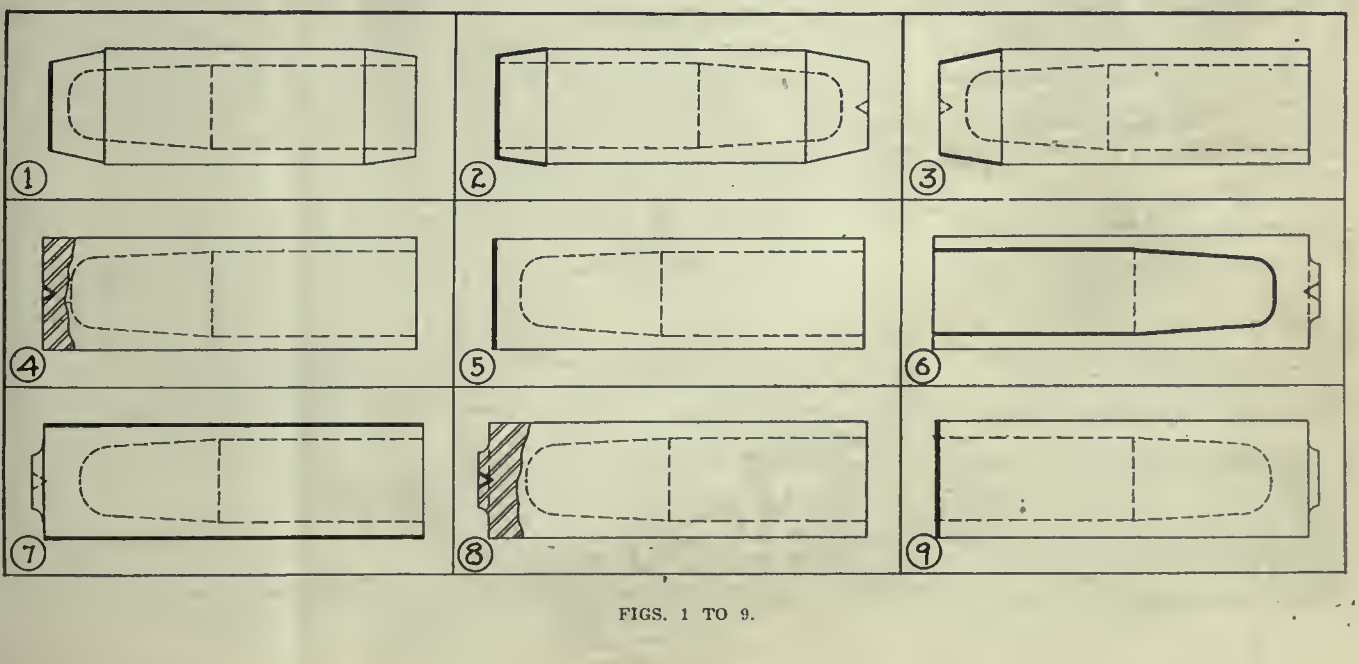
3rd operation (see Fig. 3).—An engine lathe is used. A mandrel to fit lathe spindle centre having three fixed hardened tool steel jaws set at a slight taper in a machine steel shank is used. The tailstock centre is applied to the centre in the closed end of the shell. Gauging—Gauge high and low diameter.

Bore

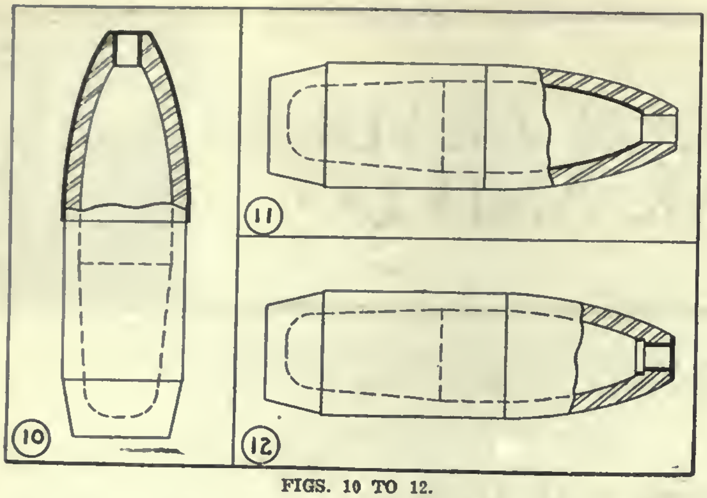
4th operation (see Fig. 4).—Rough and finish bore on a special boring machine or turret lathe. The shell is held in a clamp chuck. The first cutter is used to remove the scale from the bottom of the bore (should forgings run fairly close to finished contour this cutter may be omitted, otherwise its use is advantageous). The second cutters are for the straight part of the bore. The third cutters (old finishing cutters notched) are for roughing the taper and bottom of shell. The fourth cutters are for finishing the straight part, taper and bottom. Gauging—Gauge diameter and depth of bore.

Rough Face Base

5th operation (see Fig. 5).—The shell is held in a collet chuck, the bottom of bore being forced against a stop fixed in the centre of the chuck. This enables



FIGS. 1 TO 9.



FIGS. 10 TO 12.

the operator to set the tool, by means of another adjustable stop on the lathe carriage, the required distance from this stop. Special open end machines are very desirable for this operation. Gauging—Gauge thickness of base.

Re-Centre Closed End

6th operation (see Fig. 6).—This operation is carried out the same as operation 2, the same fixture being used. Gauging — Gauge depth of centre. Note—This operation is made necessary in order to secure concentric shells, i.e., by means of locating this centre from the bore, and then using this centre for finish turning this is accomplished.

Chamfer Body

7th operation (see Fig. 7).—Lathe or special open-end machine. Shell held in collet chuck with stops, as explained in operation 5. A flat forming tool is used. Gauging—Gauge form (angle) and length of taper. Check diameter across base.

Bevel and Face Open End to Length

8th operation (see Fig. 8).—Lathe or special open-end machine. The shell is held in a collet chuck, being forced against a stop at the bottom of base. A set stop (adjustable) on lathe carriage fixes the length of shell. A block tool holder is used; a flat forming tool and cut-off tool (wide enough to require no cross-feed) is used. Gauging—Gauge form (taper) and length of bevel, diameter across open end. Check length of shell.

Finish Face Base

9th operation (see Fig. 9).—This operation is carried out the same as operation 5. The gauging is identical.

Nose In

10th operation (see Fig. 10).—A hydraulic press is used. The open end of the shell is heated in an oil or gas furnace, an oil furnace being preferable. The shell is then placed in the press against three locating pins, the die brought down, and the shell nosed in. Although cast iron dies are successfully used, machine steel ones stand up to the work better. In either event they should be water-jacketed. Two upright stops (one on each side of the press) determine the length of shell. Gauging—Gauge diameters of fuse hole (at top and bottom), length of fuse hole, contour of nose and over-all length of shell.

Finish Inside Contour

11th operation (see Fig. 11).—This operation is carried out the same as operation 8. A forming cutter is used. It is held in an oval (section) bar, with a roller at the end of the cutter in line with it, which brings this cut in line with the bore proper. Gauging—Gauge length of fuze hole.

Ream Fuse Hole

12th operation (see Fig. 12).—The shell is again held, as in operation 8. A four-way or turret tool post is used. The first tool rough bores the fuse hole and faces it to length; it carries a stop which strikes the bottom of the bore. The second tool recesses the rear part of fuse hole. The third tool reams the fuse hole (part to be threaded).

Finish Turn Body

13th operation (see Fig. 13).—Engine lathe with collet chuck to grip base end of shell, expanding centre at tailstock end to fit fuse hole. Stops on carriage and lathe to determine correct diameter. Gauging—Gauge high and low diameter.

Finish Turn Shoulder and Nose

11th operation (see Fig. 14).—Engine lathe with shell held, as in operation 13. Cam profiling attachment at back of lathe with roller guide arm on carriage. Gauging—Gauge high and low diameter of shoulder and form gauge for nose profile.

Thread Fuse Hole

15th operation (see Fig. 15).—Special single purpose thread miller or engine lathe with collapsible tap. Gauging—Gauge high and low diameter. Thread gauge for form and size of threads.

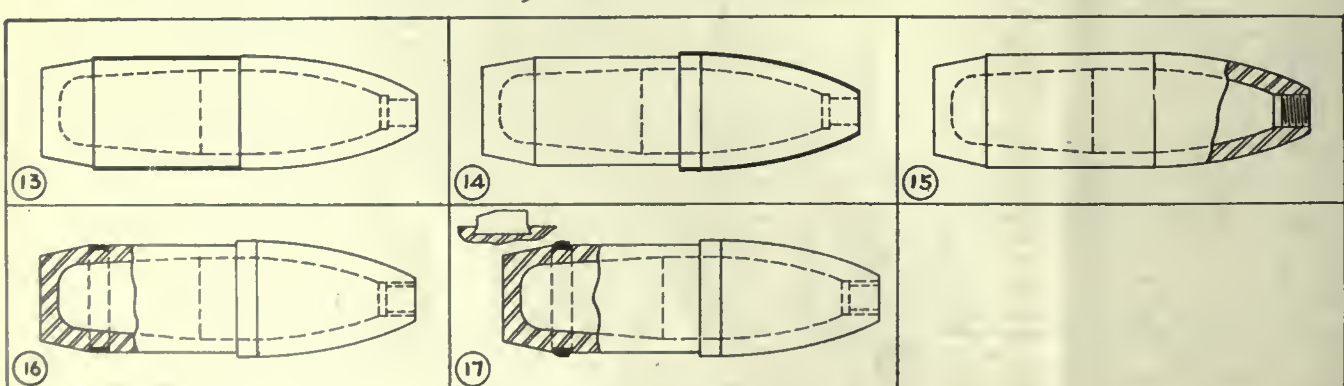
Groove

16th operation (see Fig. 16).—Special open-end machine or engine lathe with collet chuck. A circular grooving tool is used. The two undercutting tools are mounted in holders, which have racks cut in their shanks. By means of a gear wheel to mesh with these racks the undercutting tools are fed forward at the desired angle and width. Gauging—Gauge angle of undercut, width of groove, distance of groove from base, high and low diameter of groove.

Turn Band

17th operation (see Fig. 17).—Same equipment as used in operation 16. Two flat forming tools—one for roughing and the other for finishing. Gauging—Gauge high and low diameter of band and form.

The presence of acid in oil or grease is very deleterious to the bearings, especially ball bearings, as it causes more or less rapid corrosion. To test oil for acid, clean a piece of sheet copper, cover it with the oil and let it remain for several days. Should a green deposit form on the copper it may be concluded that acid is present. Lubricating oil or grease should be absolutely neutral in its character.



FIGS. 13 TO 15.

MILLER WAS USED WITH SEMI-AUTOMATIC FIXTURE ON THIS JOB

By D. A. THOMPSON

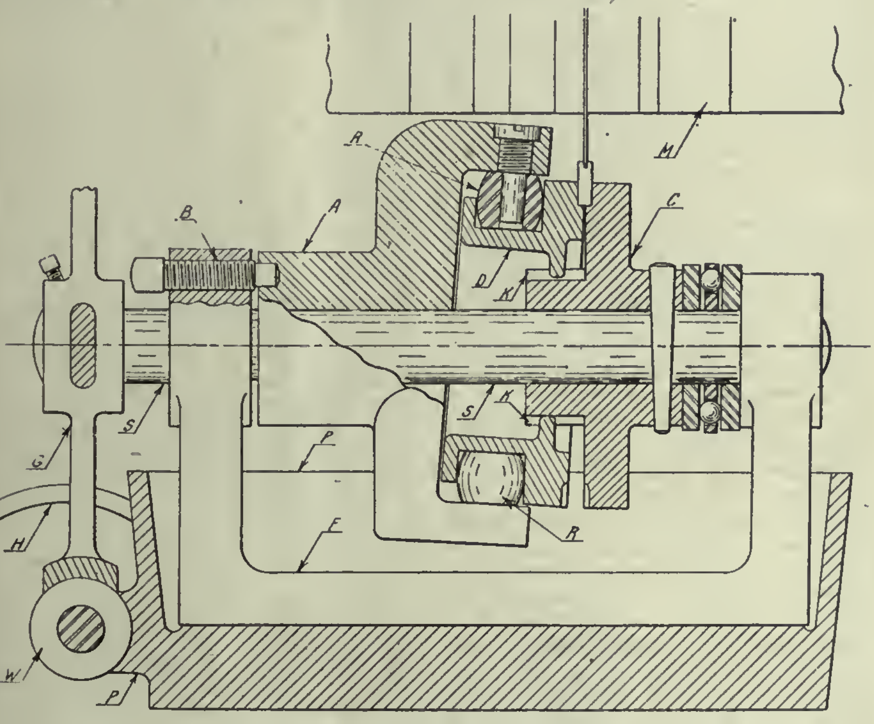
THERE is a device used largely in Canada and the United States in the training of marksmen that fits inside the bore of the service rifle. The blow of the hammer is transmitted to a tempered rod sliding in bearings in a thin brass tube; one end of the rod is pointed, and, when the gun is fired, strikes a miniature target set up at a correspondingly reduced distance from the muzzle of the gun. A spring returns the rod to its place inside the tube. The device is used in the instruction of recruits in sighting, aiming, and general handling of the rifle and by more experienced riflemen to keep in practice in times and places that the outdoor ranges are not available. Economy is a feature for no ammunition is used—instructors say that the practice is the best possible without ammunition, only the recoil and the noise being absent.

The shop had taken a contract to manufacture parts for some twenty thousand of these devices of one make. One of the jobs was the milling of a slot 1-16 in. deep in the ends of pieces of ¼ in. steel; at the beginning it was intended to do this on the five spindle screw machine that turned out the parts, but a few days' running disclosed conditions that made it advisable to do the slotting separately. As there were nearly 150,000 pieces to be handled some quick way of loading and unloading was imperative. The fixture for this work is shown by the drawing.

A Miller Was Used

A hand miller was selected for the job. The fixture was fastened to the table directly under the arbor and parallel to it with power for rotation furnished by a ¾ in. belt to a pulley H on the worm shaft which was on the free end of the fixture overhanging the table. The worm W drove the gear G fastened to the main shaft S on which were mounted the work holding parts. The casting F provided two bearings for the shaft and in turn was bolted to a pan P that served also as a base and a support for the worm shaft.

The work holding mechanism consists of a casting A kept from revolving by the set screw B, a loose fitting ring D driven by the disc C which is pinned to the shaft, there being two keyways on the inner hub of C in which projecting portions of D fit loosely. A groove or race in D is the means by which D is moved closer or farther from C, accommodating varying sizes of stock and giving different grips on the work. Three rollers R are pivoted on screws in A and travel in the race way. Set screw B is turned to bring D nearer to C.



FIXTURE TO AID IN THE RAPID CLAMPING AND RELEASING SMALL PIECES IN THE MILLER.

From the drawing it will have been noticed that D and C are not in parallel planes—this is meant to be so, and is the somewhat unique feature of the fixture. Two of the rollers R are placed below the shaft, 60 degrees each side of the vertical center line and both of them back of the upper roller, which arrangement tilts D and provides a real grip at the top only. Twenty degrees each side of the top the work may be pulled out with the fingers. Advantage is taken of this to put an ejecting finger between the two discs (on a 45 degree slant) which unloads the work pieces into a chute without any attention. A boy stationed on the "closing" side loads the fixture which has holes spaced on ⅜ in. centers.

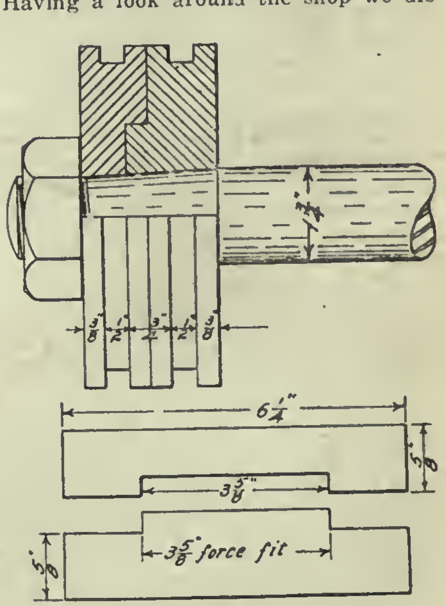
The operation was practically continuous. Aside from loading the boy had little to do. At the bottom the work recesses were cleaned by passing through the liquid in the pan—an overflow and the ejecting finger on the far side are not shown. A drip can supplied lubricant to the cutter which is on the arbor M. To relieve the friction from the set screw a ball thrust bearing was installed. When this job was finished a new set of holes were put between for another similar job.

EMERGENCY REPAIR TO PISTON

By J. H. HOULDSWORTH

EMERGENCY repairs are frequently an important factor in maintaining the efficiency of a machine shop or power plant. Under certain conditions it is very often necessary that repairs be made at once to avoid shut down of the plant or one of the departments. Where equipment must be operated without rest the maintenance of such requires the most careful attention on the part of the engineer in charge.

The accompanying sketch shows the repairs made to a piston when the same was required at a time when all foundries were closed. This piston was used in a pump which was operated twenty-two hours per day, and the break developed at a time when a replacement in the ordinary way was impossible owing to the fact that it happened about noon on Saturday, with all foundries closed for the week. Repair was absolutely essential so some method had to be adopted to get the pump running again. After dismantling the pump it was found that the rod was also bent. The latter was not so serious, as the straightening was soon accomplished. Having a look around the shop we dis-



PISTON REPAIR SAVES SHUTDOWN.

covered a couple of old balance weights with a diameter of 7½ inches and a thickness of 2¼ inches, from which we made a very satisfactory piston as shown. We had two lathes available, so one was set to work to rough down the weight to about ⅛ inch of the required diameter of 6¼ inches, and the hole bored ⅛ inch smaller than the small end of the taper. The other lathe was then started on the second casting, this being roughed in a similar manner, with the exception that the hub of one was made a force fit for the other. One of the pieces was then removed and pressed into the other without removing the latter from the face plate. The two were then held firmly together by means of suitable clamps, and the center hole bored out to fit the taper end of the rod. After securing the piston on the rod the rod with the piston was placed on the lathe centers and the head finished to the proper diameter and the piston ring grooves turned in. We were able in this way to have the pump working before night, thus avoiding the necessity of obtaining a new pump. The pump was shortly afterwards replaced by one of greater capacity, and the old one sold, but the latter is still in good working condition, no trouble having developed from the impromptu repair.

BURNLEY'S SOLDERING PASTE

By M. E.

A flux for use in soft soldering has been sold on the market under this name for a number of years and has given good satisfaction. It is used in the same manner as chloride of zinc flux, but is not supposed to corrode the work upon which it is used. In this respect it is superior to the usual liquid chloride of zinc flux, but is not entirely free from corrosion as it is believed that there is nothing which is actually non-corrosive when used as a flux, otherwise it would not act as such.

The particular advantages of this flux are in its portability (there is nothing to spill) and the ease with which it can be used. The manner of making it is to first make a saturated solution of chloride of zinc of a neutral character. The two requirements are absolutely necessary, and are easily accomplished. To make the saturated chloride of zinc solution, metallic zinc is dissolved in strong muriatic acid. Any crystals which form in the bottom of the dissolving vessel are dissolved in just enough water to take them up. By the use of strong muriatic acid hydro-chloric) acid, this is accomplished. In other words the chloride of zinc solution is as strong as it can be made.

The neutral condition of the solution is produced by having an excess of the metallic zinc in the liquid when it is being dissolved in the muriatic acid. In other words, there must be more than enough zinc used to take up all the muriatic acid. When the acid ceases to act, which may be known by the cessation of gas bubbles from the zinc itself, the action has stopped and no more zinc will dissolve. At this point there should be more or less zinc left in the bottom of the vessel in which the dissolving has taken place. The whole should be allowed to stand for an hour or more in order to give the acid a chance to dissolve all it will. The solution, then, will be neutral, for the reason that the acid has dissolved all it can and if strong muriatic acid is used, a saturated solution will have been obtained. This solution of course, is the regular chloride of zinc soldering flux, but it is made in the right manner. The common error found in making it is to have too much water present and a quantity of free acid which of course, means muriatic acid not used up on the zinc. This interferes with action in soldering. It also corrodes the metal that is soldered. There has been obtained therefore, a saturated and neutral solution of chloride of zinc. This is the base for the manufacture of the paste and is the flux which acts on it.

The chloride of zinc flux thus produced is mixed with a grease and the paste is ready. For the grease, the inventor recommends "vaseline" or "petrolatum" both of which are the same thing under a different name. Petrolatum is the cheaper of the two. The proportions of the grease and chloride of zinc flux used are as follows:

Saturated Chloride of Zinc Solution 2 oz. (fluid.)

Petrolatum or Vaseline 1 lb.

These two ingredients are mixed by violent stirring until the mixture begins to thicken when it is poured into the receptable in which it is to be used. If any other grease is to be used, the same proportion is to be employed.

This paste was originally patented by Wm. Burnley of Miamisburg, Ohio, and James and Burnley of Cottonwood Falls, Kansas, and the patent was granted on Aug. 9th, 1918. It has about a year longer to run before it elapses

MACHINE SHOP HEATING AND VENTILATING

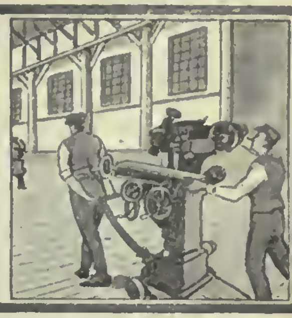
By "Dale"

Considerable difficulty is experienced in arranging for the heating and ventilating of the single storey sheds with saw-tooth roofs now in universal favor for light machine shops. The wide expanse of surface exposed to the weather in such buildings makes the task of maintaining a comfortable working temperature difficult on cold days, and while roof ventilators and fans afford adequate ventilation in summer, they are invariably put out of action in winter on account of the excessive down draught of cold air, whereupon the air in the centre of the shops becomes stagnant and impure. But satisfactory hygienic conditions are essential to the maintenance of efficiency; hence some method must be devised to supply warm, fresh air in the winter, and cool air in the summer to all parts of the building. A good arrangement has been in work for two years past in a well known English plant at Birmingham. It consists of a number of cupola-shaped heaters (four in this particular case) distributed about the shed, each of which draws air by means of a 15-inch motor-driven horizontal propeller fan, located at the down inlet pipe protruding through the roof, passes it through a battery of steam pipes, and ejects it at the floor level, whence it rises and circulates through the building. The down pipe is fitted, just below the roof, with a swinging damper which can be moved so as to block the admission of outside air and allow the warm air from inside the shop to be passed and repassed through the heater. This is very beneficial on cold mornings, as it enables the air to be raised to a suitable temperature in a short time, whereupon the damper can be moved back and the temperature maintained with the cold air outside passing through. This feature is a distinct improvement on many other types of heating apparatus. The steam is supplied to the heaters from a vertical boiler 9 ft. high by 3 ft. 9 in. diameter (which if worked at 80 lb. per sq. inch, is capable of serving eight heaters in the coldest weather) through 1 in. branches from the main steam pipe, and is trapped at the outlet with a steam trap of the float type, in order to prevent the passage of uncondensed steam. The condensed steam, after leaving the trap, is forced along a ¾ in. pipe, past a check valve, into the main return pipe, which conveys it to the boiler feed t

The legs of the heater are utilized as a means of connection to the stem and drain pipes. Valves are fitted to both pipes of each heater, so that one can be out for repairs without disturbing the others. The temperature can be varied by altering the steam pressure, by varying the quantity of steam passing through the steam valves, or by means of the motor regulator, the latter being arraned to give four different speeds. During the warmer weather, when it becomes unnecessary to use the heating part of the apparatus, the fans are used for ventilating only. The impure air escapes through the interstices in the doors and between the valley gutters and the lower purlin on the glazed side of the roof. By reason of the pressure inside the building being slightly greater than that of the atmosphere, all leakages are from the inside outwards, and hence draughts are prevented. The cost of this method of heating and ventilating compares very favorably with any proprietary system, and at the same time meets all the requirements of a modern heating and ventilating plant.

Matheson, Ont.—The construction of a complete system of electric light and power at an approximate cost of $10,000 is having the consideration of James A. Lyttle, deputy clerk of the municipality and ratepayers of the town.

DEVELOPMENTS IN SHOP EQUIPMENT



Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

GRINDING AND FINISHING MACHINES

A GRINDING and finishing machine of high efficiency is shown herewith. This machine, made by the Blevney Machinery Co., Greenfield, Mass., embodies their two-belt principle of operation. A heavy and substantial cast iron frame of box pattern carries a polishing head with three pulleys, over which the corrugated leather and cloth abrasive belts are run. These pulleys operate in bores and frames having suitable adjustment for controlling the travel of the belts with provision for automatic regulation of the belt tension.

The patented corrugated leather belt is driven from the central pulley around the small idler pulley at a speed of 7,000 ft. per minute. The cloth abrasive finishing belt is placed over the cushion belt running over the idler pulleys in each end of the polishing head.

The table to which the turret is attached is vertically adjustable by a handwheel. When the machine is in operation this table is given a side oscillating movement, adjustable to suit the different classes of work.

The cloth abrasive belts do away with all centrifugal action upon the finishing grains where they are under strain, and as compared with the disc grinder they provide a uniform speed for each grain, the disc grinder grains being subject to different speeds on account of their location at different points from the center of the disc.

The productive powers of these machines are made possible through the use of the two-belt system. The corrugated-leather cushion belt runs at 7,000 ft. per minute and the cloth abrasive finishing belt which runs over the former operates at a slightly increased rate of speed due to the enlargement of the driving pulley which is increased in size by twice the thickness of the cushion belt; the increase in speed being about one and a half inches on each revolution of the main pulley. The increased speed of the cloth abrasive belt is neutralized in operation when pressure is applied behind the belts with the result that the travel of the abrasive belt is somewhat retarded at point of work so that it must curve into high and low sections following the corrugations in the cushion leather belt. In this manner high points for cutting and low points for chip recess are obtained. After the belt passes point where work is held, it expels the chips and resumes its normal position.

By means of this process the chips are disposed of immediately as generated or cut instead of being rolled along the face of the work scratching and defacing it.

GRINDING AND FINISHING MACHINE

OIL BURNER

To obtain the best results from fuel oil, it is essential that the right kind of burner be used and it be properly installed. An oil burner in order to give satisfaction in operation, should be designed with the following features: to secure thorough atomization of the oil, to operate without causing oil opening, to be under complete control of the operator. The oil burner illustrated herewith has been designed by the Foundry Equipment Co., Cleveland, Ohio, with these points in view.

SECTIONAL VIEW OF OIL BURNER

The Coleman Oil Burner is unique in the manner in which the oil is atomized and mixed with the air. The air is sent from the main air chamber to a hollow brass stem. The oil is sent around this circular stream of air, and at the end of the brass stem, which controls the air supply, the oil is forced into the air stream at sharp angles. This causes a breaking up of the oil into small particles and produces a primary mixing with the air. A second and outer stream of air, cutting through the primary mixture, produces a further atomization and furnishes the proper combination of oil and air for complete combustion.

The burner connections provide for a one-half-inch oil line, 2-inch air line, giving a wide range of both oil and air.

Perhaps the most interesting feature in connection with this burner is the double mixing of air and oil which takes place in the burner. This is due to the arrangement by which a circular stream of oil flows between two air supplies, one on the inside and one on the outside.

DRILL GRINDER

The Grand Rapids Drill Grinders illustrated herewith are made by the Grand Rapids Grinding Machine Co., Grand Rapids, Mich. These machines embody several features of interest and value. A properly constructed spindle and a rigid and heavy housing are prime essentials for satisfactory grinding machines. The housing is part of the main frame casting. The spindle is made of 60 to 80 point carbon, hammered crucible steel, hardened ground and running in ring oiled phosphor bronze bearings, easily adjustable for either radial wear or end play, of simple construction. The bearing is dust-proof—a most essential point for any grinding spindle.

The drill holder proper is so designed that either straight shank or taper shank drills of standard type can be ground, and drills with enlarged shanks or drills mounted on quick change sockets can be ground with equal facility and without any changes or extra adjustments of any kind.

Lip-rests have caused more trouble in twist drill grinding machines than all other features combined. The lip-rest on this machine is really four lip-rests in one, as it can be put on so as to use either edge for the drill supporting edge and it can then be reversed top for bottom, and can in that position again be reversed so as to give four distinct settings, and at the same time there is an adjustment up and down to provide for wear. It is impossible to get the lip-rest on wrong, and should occasion require, it is so simple in its construction that any user can easily make a duplicate without much danger of going wrong.

A swinging arm with a diamond mounted therein and convenient means for adjusting same in the process of truing the wheel, is provided. In the case of double holder machines, a truing device is furnished for both wheels, and a diamond is a part of the standard equipment furnished with each device.

In connection with the truing device, there is provided a stop, in the form of a track on a movable section of the wheel hood. As the diamond is advanced into the grinding wheel in the process of truing it, this movable section of the wheel hood with its track is advanced an equal amount, hence it always remains a fixed distance from the face of the grinding wheel. A circular stop on the front of the drill holder abuts against the track referred to and rocks in the process of swiveling the holder. It is so adjusted that it brings the lip-rest into that extremely close proximity to the wheel, which is necessary for a perfect grind. At the same time, it is impossible to get the front of the holder or the lip-rest into the front of the grinding wheel. where it could be ground off.

Drills working on tool steel require very little clearance and a strong cutting edge. Those on soft grey iron require much greater clearance and do not require as strong a cutting lip. For maximum service, it is necessary to be able to rapidly adjust clearance and do so without danger of getting the rest of the adjustments out of order. In this machine nothing has to be clamped and nothing has to be tightened up. It is only necessary to turn a small hand wheel which rocks the holder proper in its swivel bearing. It canot get loose, nor slide up and down in its bearing during the process of adjusting clearance.

The only adjustment necessary is that necessary to accommodate different lengths of drills. No calipering and separate settings for individual diameters is required. No machine is more simple in its operation or efficient in service.

On wet grinding machines the end of the drill being ground is flooded by a stream of water or coolant 1½ inches wide and about ¼ inch deep, which drops directly on the point of the drill without any force. It is carried to the special flat nozzle through ¾-inch bore. Hoods, waterpan and guard are so arranged that they keep the water in the machine and off the floor. All pump bearings are above the water line and it is driven by a flat belt without the necessity of any idler pulleys.

Niagara Falls, Ont.—The National Abrasive Co. will start erection of a plant here at once.

DRILL GRINDER WITH PAN AND COOLANT RESERVOIR

DRILL GRINDER

HEAT-RESISTING PAINTS

By Mark Meredith.

The best heat-resisting paints are made from hardened asphaltum or pitch, dissolved in a fluid solvent; whilst for temperatures below the boiling water, casein, animal albumin and alkali silicates have given good results, writes a German authority. Pyroxylin varnish is very durable, but browns when heated, and can only be used when in admixture with black body colors. The following preparations are worthy of mention.

Roman Prasser's Recipe.—Equal parts (40) of pigment and spirit varnish (compounded of 1 part of bleached shellac in 7 parts of spirit) are intimately mixed with 1 part of camphor and 5 parts of bleached oil varnish. The article to be coated is brushed over several times with a mixture of gypsum and spirit varnish, flatted and painted over with the above preparation, being finally polished lightly with shellac varnish. This paint will stand the heat of boiling water for some time, but browns on prolonged exposure and peels off.

G. M. Neisel's Recipe.—Solid fats or fatty acids are distilled at 250 to 300 deg. C. with superheated steam. The residue being mixed with about 10 per cent. of red lead and 2 per cent. of litharge, treated with superheated steam at 400 to 500 deg. C. and thinned down at 150 to 200 deg. C. to workable consistency with linseed oil. As an alternative method the dilution with linseed oil is replaced by blowing in 25 per cent. of petroleum vapor, and then diluting with the crude benzol or other dilutent when sufficiently cool. The product is said to dry with a glossy surface, and to stand a dry heat of 500 deg. C. or damp heat up to 250 deg. C. As a matter of fact, an asphaltic substance and especially the distillation residues from fats (bone pitch, etc.) are capable of resisting high temperatures, and are used for stoving enamels.

Meyer's Recipe.—Residues from the distillation of fatty acids are heated to about 500 deg. C. with lead oxide and lead peroxide for three to four hours until thoroughly combined, the mass being dissolved in mineral oil and thinned down with turpes.

Bethisy's Recipe.—The mass consists of nitro-cellulose and a solution of calcium chloride in amyl acetate, with an addition of ether, alcohol, alum, talc, asbestos or mica, elasticity being imparted by vaseline oil or lavender. Celluloid varnishes are capable of standing a certain amount of heat.

Selmay Meyer's Recipe.—A heat-resisting varnish for iron ware, especially iron stoves, etc., is prepared by mixing powdered liver of sulphur, cyanide of potash, bicarbonate of soda, and sufficient cassel brown to give the desired color, and the mixture is saturated with alcohol. The pulp is passed through a sieve to remove coarse particles, and after being applied to the metal is exposed to a temperature of 200 to 300 degrees C. Other fireproof pigments may be submitted for the brown. This preparation is an enamel rather than a paint, but will stand heat very well.

Syracuse Tar.—A mixture of finely ground alum, asbestos and borax or boric acid is stirred into melted coal tar, the proportions being 60 to 65 or 40 to 50 parts of tar, 8 to 4 to 2 to 8 of alum, 20 to 5 or 38 to 30 of boric acid, 12 to 5 or 20 to 13 of borax, and 5 to 8 of asbestos. The idea seems to be that the salts will sinter together under the influence of the heat, the tar being presumably carbonized.

Avenarius' Recipe.—Ten parts of alkali silicate are heated under pressure with 25 parts of casein, a pasty mass being formed. This liquid is mixed with 0.2 part of carbonate of magnesia and 0.1 parts of borax, to increase the heat-resisting properties, whereupon 0.15 part of zinc oxide, 0.3 part of sodium phosphate and a suitable quantity of lime and earthly pigment is added to give covering power. For use, the mass is thinned with boiling water, and is said to stand a temperature of 100 deg. C. (212 deg. F.).

Fairweather's Recipe.—Equal parts of silicon carbide and semi-fluid alkali silicate are mixed together, 3 to 10 per cent. of chalk being added.

Hall's Fireproof Recipe.—This paint consists of moist silicate of magnesia, 5½ of dextrin, 5½ of gypsum, 2 of chalk, 2 of alum, and 1 of common salt. Four parts of this powder are mixed with three of boiling water for use. This preparation and the preceding one owe their "fire-resisting" properties to the sintering of the salts when heated.

Eymer's fireproof varnish is compounded of a mixture of alkali silicates with asbestos or other fireproof material and vegetable or mineral oils, or oily substances like glycerine.

Give a couple of coats of a good washable distemper, upon which should be given two coats of oil paint, the first somewhat flat and the last with a little oak varnish added to it. Painting on galvanized iron is at all times difficult, and there are various preparations on the market specially made for the purpose. If you do not care for the water paint plan try the following:—First go over the work with a wire brush so as to roughen the surface, then apply a coat of red lead well brushed out and mixed thin with boiled oil and turpentine. You will, of course, only mix just sufficient quantity of the red lead for the job, and will take care to stir from time to time while in use, as the red lead sets quickly. If there is much of the work to be done, we should recommend you to use orange lead instead of red lead, as although the two are practically of the same nature, the orange lead is a good deal lighter, and hence does not settle so quickly. You may take it that everything despends on the priming coat, and if this is satisfactory, the two or three coats upon it will hold well. The washable distemper in our experience gives as good a result as anything, and is much cheaper than the red lead system.

MEN AGAIN CONFER WITH RAILWAY WAR BOARD

Railway shopmen are returning to Montreal at the end of this week or the beginning of next to confer with the Canadian Railway War Board as to certain adjustments in the McAdoo schedule which the Federated Trades of the locomotive and car shops of the various Dominion railroads desire. The new amendments to the McAdoo schedule arrived at by the Permanent Wages Board appointed at Washington have not met the situation so far as the shopmen of Canada and the United States are concerned, and on both sides of the line it is expected that negotiations will proceed for the adjustment of wages more to the satisfaction of the men.

The varying conditions under which the different trades are required to operate makes it very difficult to establish a schedule of wages that will be suitable and acceptable to the many employees. Some further readjustment will be necessary to remove the disparities, when the same are sources of dissension among the different classes of workmen. While the conditions of the McAdoo award are generally satisfactory to railroad men throughout Canada, it is thought that some slight readjustment could be made to avoid unnecessary friction.

MANUFACTURERS HAVE RAISED PROFIT UNDULY

The Canadian Railway War Board announces that a detailed study has been undertaken which will show not merely the increase in the cost of railway haul in the manufacture of necessaries of life, but will go into the actual cost of the labor and raw materials in these articles, with a view to proving that while railway rates have increased possibly 30 per cent. since the war began, while railway costs of operation have increased by a larger percentage, manufacturers have actually increased their rate of profit out of all proportion to the actual increase in their cost of production.

The War Board gives the following list: Boots and shoes have risen in price since the war began 100 per cent.; beef, 35 per cent.; clothing, 50 per cent.; coal, 100 per cent.; cordwood, 100 per cent.; flour, 90 per cent.; gasoline, 100 per cent.; hardware, 100 per cent.; pork, 75 per cent.; sugar, 80 per cent., and tobacco, 50 per cent. The roads are paying now a 100 per cent. higher pay roll; 210 per cent. more for axles; 110 per cent. for brass castings; 200 per cent. for malleable castings; 100 per cent. for coke; 157 per cent. for iron and steel bars; 153 per cent. for fir; 80 per cent. for oak; 100 per cent. for pine and spruce; 130 per cent. for oil fuel at Montreal; 32 per cent. for oil fuel at Vancouver; 30 per cent. kerosene; 125 per cent, for steel tires; 100 per cent. for cleaning waste; 200 per cent. for lubricating waste, and 90 per cent. for cast iron wheels.

Toronto, Ont.—The British Forgings, Limited, contemplates a $15,000 extension to plant.

Should Be No Post-War Slump in Machine Tools

Great Bulk of Special Purpose Machinery Will Not Come Into Competition With General Purpose Equipment After the War—One Continuous Operation the Hardest Service For Any Machine

By J. H. RODGERS, Associate Editor "Canadian Machinery."

CONSIDERING the large volume of machine tools that are now involved in the production of munitions it is not surprising to hear many questions regarding the future of such equipment and as to their effect on post-war machine tool activity. To anyone unfamiliar with the work performed in connection with shell making the problem might well gladden the heart of the pessimist, but to those better acquainted with the duties required on this class of work, the outlook in this direction is much brighter than one would at first suppose. Had the war been of short duration the possibilities for a slump in machine tool activity would have been more favorable than the prospects now before us, and the more the war is prolonged the more certain will be a normal continuance of pre-war activity.

Business cannot possibly be maintained at the present high level when peace is declared, but apart from an expected period of readjustment we may reasonably anticipate a resumption of machinery activity such as existed prior to the opening of hostilities.

Inception of the Industry

During the early months of 1915, when the manufacture of munitions on a comparatively large scale was given initial consideration, the manufacturers in this country—although very enthusiastic—were somewhat skeptical about undertaking an enterprise so remotely foreign to anything previously experienced. The almost total ignorance of those interested was one of the primary causes of the initial delay in establishing the industry, as at that time it should be remembered that few in this country looked for more than a few months of shell making owing to the belief that the war that had been precipitated so suddenly would terminate as rapidly. With this thought in mind those firms that had received the initial contracts, guided by previous experiences in engineering activities—little reliable information being obtainable relative to accepted practice in munition making—commenced planning and buying available equipment, and also ordering additional machinery (invariably of the standard type) for the machining of the first contracts placed for shrapnel shells.

It may readily be seen, therefore, that practically 100 per cent. of the tools used on the initial orders were of a type that might subsequently be easily used for ordinary domestic enterprise. In some respects it might be stated that this was a feature that influenced the purchase on the part of those making the shells. It is at this point that a short war might have been considered as an influencing factor on what would then have been post-war conditions.

Early War Conditions

The number of machines that had been acquired or ordered during the first six months of 1915 was undoubtedly large in proportion to the general requirements under normal peace conditions. Bearing this in mind, we might have looked for a relatively quiet period following an early peace, as the bulk of the machinery had been manufactured under ideal conditions, with the best of materials and workmanship, built to stand up to the best engineering practice of the day, and in keen competition with many other makers. In the belief that the war would not be duly prolonged, the same high grade work was performed on those tools ordered for the pioneer work.

It is therefore obvious that, had the manufacture of shells closed within the first year, the greater percentage of the machine tools then employed would have been in fairly serviceable condition and could have been profitably utilized for ordinary commercial work, but the long service imposed on these and subsequent equipment will mean only one ultimate result—the scrap pile—as a temporary resting place before being again converted into more useful material through the medium of the cupola or one of the several types of furnaces.

Special Machine Development

Few factors have had a greater influence on the future of the machine tool industry than the inability of the builder to supply the primary demands of the pioneer shell manufacturers. If standard tools could have been obtained in sufficient numbers to satisfy the early requirements it is doubtful if the remarkable record that has been attained would ever have been accomplished. It is due, very largely, to the fact that shell makers were virtually forced to take the initiative and utilize their own individual resources to meet the situation that increased in magnitude every week—almost every day—that we have been able to achieve the results of the past several years.

Unable to secure the desired machinery, and feeling the increasing tension from day to day, the dormant qualities of the engineering profession gradually awoke from the stupor of established precedent, and superintendents, foremen, and mechanics began to create what may eventually prove to be the foundation for material evolution in machine tool design, construction and operation. While waiting the delivery of tools from the builders, the different shell plants—working on their own initiative and utilizing the material available—began designing and building impromptu attachments for use on the existing equipment to facilitate the production of the shells. These appliances were generally only intended to fill a gap, pending the installation of the standard machinery. The efficient operation of many of these devices, however, was frequently so remarkable that many were retained in service even after the new machinery was installed.

It is due to these crude devices giving such excellent satisfaction that the manufacture of munitions is now universally performed on tools specially designed for specific operations. Production in larger quantities, coupled with standardized product, requiring a relatively high degree of accuracy, resulted in the construction of special single purpose machines, invariably adapted for one particular operation. While many of these special machines could be converted to perform work of a somewhat similar character, the accepted practice is to reserve each individual machine for one operation exclusively.

Revolutionary Changes

Those who have been in close touch with the munitions activity ever since its inception can easily recognize the widely different types of machines that are now employed for the making of shells over those first adapted for this purpose. Two years ago one could visit a shell plant and see there large numbers of standard lathes, many of which were equipped with all the additional attachments and facilities for ordinary commercial operation on variety work. Lathes of various sizes and lengths, those fitted with every modern improvement, such as quick-change gears, screw cutting arrangements, and other accessories which made the machine adaptable for a wide range of work. Many of these tools are still to be found in shell factories but where they are being operated for actual shell production it will be found that many of them have been stripped of such appliances and practically redesigned or remodeled for some specific operation.

However, where plants have been constructed or enlarged during the past two years and new machinery installed for the making of shells, it is seldom that pre-war standard equipment has been acquired—excepting, of course, these machines necessary for tool room work, such lathes always requiring to be of high grade quality. Undoubtedly, a considerable number of standard lathes that have been working on shell production will be utilized for different purposes after the war, but to do so it will be necessary to have the same completely overhauled before the machines can be used for anything like accurate work of a general character.

Effect of Constant Use

The extreme service that shell machinery has been put to, and under the hands of men seldom qualified to operate machinery under normal conditions, has virtually left the bulk of munitions equipment in such a state that the conversion of the same to domestic purposes would be almost impossible. Apart from the rough handling that such tools may have received at the hands of unskilled labor, the nature of the present work is the chief factor effecting the rapid deterioration of this equipment. Under normal peace conditions the range of work performed on machinery in general is of a character that tends to neutralize the wear and tear on the various working parts, as in the majority of metal working establishments the duties required are of a variety to use—almost periodically—all portions of the machine.

Exactly the opposite is the case in shell making practice, where each machine is adapted to one specific detail in the entire sequence of operations. Thus it is obvious, where machines have not been especially designed for some one particular operation, and they are doing this operation for anywhere from one to three years, the abnormal service will eventually, if not already, have practically destroyed the serviceability of the machine for any other duty.

Post-War Possibilities

Four years of war, with its contingent effect upon every branch of engineering and commercial activity, might well, however, give some cause for serious reflection, particularly in relation to the possible development after the war, arising out of the unique experiences of those interested in present abnormal enterprise. Engineering practice, probably more than any other, will be affected by war activities, as production methods have been greatly changed as a result of the knowledge derived by the successful achievement of an enterprise that would have been considered impossible four years ago.

While these revolutionary changes have doubtless been restricted, almost entirely, to developments in design and construction of shell making machinery, it is reasonably safe to predict, or at least anticipate, that post-war conditions will be greatly influenced by what has been learned from the munitions industry. The possibilities of the single purpose machine, as an economic feature of quantity manufacture, has been increasingly emphasized during the past three years, and it may be expected that this class of equipment will be given stil lgreater attention in the future than ever in the past.

However, one of the chief objections to any general adoption of the special or single purpose machinery, is the small number of manufacturing plants using metal working machines, that could apply this method in the production of their product. It will, therefore, be evident that, until quantity manufacture becomes more general, the single purpose machine will not be a serious contender for honors after war, unless some drastic steps are taken towards closer co-ordination of Canadian manufacturers. Nevertheless, the experience gained regarding the possibilities of changes in fundamental design of machine tools, as shown in some of the machines now engaged in shell production, will undoubtedly affect the construction of future tools for different lines of engineering. It is not unlikely that competition will be keener than ever before, the consequence being that the most modern equipment will be essential to economic manufacture.

Current Events in Photograph

THE BAND COMES BACK.

The photo presented herewith is typical of the changed condition of affairs in France. The band, which has been sent to the rear, is marching back through the quiet French villages to once more find its quarters near the front. It is a circumstance that marks the passing of the period of retreat and marks the days of the advance.

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Greater Things in This World Than Dollars

A company with a large selling force has one man on its staff in the Eastern section of Canada who does a large business. He makes a lot of money for his firm, and he makes a lot of money for himself. He is regarded as a good business man. But he could do twice as much business if he only knew it.

A few weeks ago he sent in an order to the head office in an Ontario city for two carloads of goods. The price he had quoted was $4.50 per ton higher than the price on the company's accredited sheets for that period. The purchaser had been very keen to get a supply. The salesman was quick to realize this, and took occasion to pick off a few more dollars on the deal. The company could have filled the order at the higher price. It would have made some $400 on the shipment and the salesman would have been credited with that much extra.

The company did not stop to write. It wired first to the consumer stating that the order would be filled at a price $4.50 per ton less than quoted, and the next wire went to the salesman. It is not necessary here to state what that wire announced.

A letter followed stating that the company had one price for its goods. When an increase was made every buyer was notified in advance and no favors were shown.

It's too bad that more people can't get that same system worked in under their skins. There are so many people with a dollar bill or a fifty-cent piece jammed up and glued up against their eye that they can't for the life of them get a proper perspective. If they were permitted to gaze out upon the most wonderful sunset that the hand of the Almighty ever painted they could see nothing but the fifty cents or the dollar that might be gathered in from selling reserved seats to witness the production.

The man who is making his first thousand or his first ten thousand will tell you that grabbing money is the greatest occupation in the world. The man who has grabbed and gathered will tell you that he is just as keen to grab a hundred thousand as he was to grab his first ten.

The man who goes into business with the money-grabbing instinct burned into his brain is going to make a miserable failure in the long run. He may get a reputation for being keen—a few deluded individuals may even regard him as shrewd in his dealings. But allow for all that. What else is he getting out of life? Mighty little. And when he gets to the end of his string he will have the poor satisfaction of looking back over a lot of joyless days, penurious nightmares that he thought once were prosperous days—a trip barren of friendships and a career that will bring few mourners to his day of departure.

Your business career is pretty much like anything else. You will get out of it what you put into it.

Replacement is the Real Cost Price

JOBBING houses in the Dominion are at present in touch with the War Trade Board regarding the price at which their merchandise is being turned over. The steps taken to fix prices here are rather out of the ordinary. Some time ago jobbers were asked to name prices at which sales were being made. The selling price of plate is recognized now at $10 as the minimum. It is worthy of note here that the same material used to be traded around the $2.25 mark in Canada, while in years not far away sales were made in Pittsburg at the figure of $1 per hundred.

At the Canadian mills $7.50 is recognized at Ottawa as the figure accepted and allowed. The War Board is going farther now, and a request has been made of the jobbers that they furnish to the authorities the cost price of the material that is passing from their warehouses. The jobbers, on their part, contend that the government knows the present prices they have to pay, and therefore they know the cost of the material they have in their stores. They take this position because they hold that their costs, past or present, are determined solely by what it would cost them to replace the stock at present prevailing prices.

It looks as though the jobbers were on solid enough ground in taking that position. It is a recognized position. If the government do not accept that ruling they will have to accept the responsibility of guaranteeing to the jobbers that their stock will be replaced at the price at which they paid for it, a thing they cannot do.

As soon as stock, in the form of a security, takes a rise in the market quotations, every share benefits. It is not possible that it could be otherwise. When a slump sets in and values depreciate, every shareholder is poorer in accordance with the amount of his holding. It could not well be otherwise.

When United States placed the price of electrolytic copper at 26c recently, increasing the price from 23½c, all the copper in the country moved up to the new figure. We have not heard of dealers who said they secured theirs at a lower figure, and therefore refused to regard it as being worth 26c. It would cost them 26c to replace their stock. Therefore it was worth 26c to them.

The man who buys the material may not like the idea of having to pay top prices for something the seller purchased in a lower market, but his redress is that he is passing it on into a market that is working at a higher level, and able to absorb the increased price. At any rate it is sound business to put it down as a starter that the worth of any article to you is the price you would be called upon to pay were you going into the market to replace it.

EXPERTS have it all figured out that the Germans may retreat to the Somme. And while we're at it, it will do no harm to recall that back of the Somme there's a bit of a stream called the Rhine.

IT'S quite certain that there's some few people around the office of the Toronto *Globe* who never wandered around a machine shop. An ad in quite conspicuous type, nicely framed, announced that the Dodge Mfg. Co. wanted "Boiling Mill Hands and Laying Hands." The "Boiling" part of it may have had something to do with the 102-degree weather, but we can't tumble to the "laying" hands, knowing that the Dodge people have no poultry yard. "Boiling" and "laying" is a fairly long way from "boring" and "lathe."

"DOES IT PAY?" NOT ALWAYS BIG CONSIDERATION

J. S. Woodhouse Started Work at $1 Per Week 19 Years Ago—Now General Superintendent Over 1,200 Workers in the Same Shop

LIKE most men who have got to the top, or near it, J. S. Woodhouse was reluctant to be interviewed for publication. In fact, his consent was not won until it was made plain that the purpose of the interview was to enable CANADIAN MACHINERY to dispense encouragement, especially to all younger men in Canadian machine shops who are workers by day and students by night. Even then he requested:

"Just give the bare facts.'

All of which goes to show that the self-made man without exception has a soft place in his heart for the younger chap whose aim nears the perpendicular.

J. S. WOODHOUSE

Although born in the town of Lindsay, Ontario, 34 years ago, Mr. Woodhouse has been a resident of Toronto for almost as long as he can remember. He is of English parentage on his mother's side, of French on his father's.

When only 15 he dropped public school books for the more formidable text books of the machinists' craft, and entered the employ of Mr. W. H. Banfield. Except Old Country trained machinists probably few men in Canada experienced work at pay as lean as his in those early years.

"I started at a dollar a week," Mr. Woodhouse said. "And I was given an increase of fifty cents each six months until I was making four dollars weekly."

"But you realized your pay wasn't altogether in the coin of the realm," CANADIAN MACHINERY suggested.

"Yes, I suppose I must have," Mr. Woodhouse admitted. "I recall one offer I had that nearly staggered me. It was made by a shop across the street. Thirteen dollars a week, I think it was. Three times as much as I was making, but I didn't take it."

At the age of 24, after nine years of combined work and study, the latter frequently extending far into the night, Mr. Woodhouse accepted a position with the Ontario Metal Stamping Co., of Toronto. In making the change his object was to acquire experience in American manufacturing practice. Four years later, his object attained, he returned to W. H. Banfield & Sons, Limited, as superintendent of manufacturing. Soon after he was promoted to the position of general superintendent.

It might be said that the Banfield plant has been his university. The first rudiments of machine shop practice to the fine art of die and tool making he learned in it. He worked his way from the bottom to the foremanship of each department as he climbed.

Asked whether the young men among the 1,200 employees now engaged at Banfield's had it in them to achieve an equal success ,Mr. Woodhouse said:

"Seventy-five per cent. of them, yes. And in a given time young machinists can go farther to-day than ever before. But I wouldn't say they would all be willing to work as hard as I have to get ahead."

On the termination of munitions contracts, Mr. Woodhouse expressed the hope that he would be able to retain all his better machinists. "If I can't keep them on without their losing any time," he said, "I hope to soon work them in on our regular lines of machinery, dies, tools, power presses, sheet metal stampings and brass goods. We may carry on in an enlarged way," he intimated.

Mr. Woodhouse married Miss Jennie Hyndman, of Toronto, in 1908. He is father of two little girls and one boy that do him credit.

Ever at One of These Things?

When church collections take a slump, when coin comes slow and tardy, the remedy they all apply is to hold a garden party—sometimes it is a Sunday School, and then again a league, that's sufferin' from hot weather cramps and all-around fatigue.

So the garden party's dusted off and listed up to view, and advertised as something fierce, astonishing and new.

The minor members of the flock are gathered in a row, and sent to peddle tickets for to go unto the show.

They pester folks to spend a dime, they claim the cause is just—if you don't buy up goes the snout in horrified disgust.

You plant your ticket at the gate, you pass within the coop, expectin' that you'll get a feed of pork chops, hash and soup.

An orchestra is on the job, it sits beneath a shrub, and vendors hang around to sell their garden party grub—you wander round the premises to see what you can see—and squint a Chinese lantern what's pasted on a tree.

You eat ice cream from out a dish, you gobble from a cone, until you've got but 30c from out a hard-earned bone.

And perhaps they've got a programme on, you flop your ears and listen, a speaker says the folks at home don't know just what they're missin'. And sure, by heck, you'll wander to the place, the candy booth, and chuck their home-made pillets into your hollow tooth.

The orchestra it plays a jig, but of course you musn't dance, though all the church folks surely would if given half a chance.

When quittin' time has wafted round, and they've sprung the last events, they call for every husky man to pack up booth and tents. You lift a plank, you hoist a box, you cant a pile of dishes, and kick the proppin's from the place they had their sawdust fishes.

And then you croak in voice profound, backed up with handshake hearty, "I do enjoy, by jing I do, a bang-up garden party."—ARK.

ST. LOUIS *Globe-Democrat.*—Sign in a Tonopah restaurant: "Use only one lump of sugar in your coffee. Stir like hell, for we don't mind the noise."

MARKET DEVELOPMENTS

The Fixing of Prices is Not Settled Matter

War Board Want Cost Prices From Jobbers—Latter Hold That Replacement Values Are Cost Prices—Production is Keeping Up Well in Connection With Work at Big Producing Points

THE production of steel mills in United States has a very pointed meaning for Canadians at present, more so than ever before. In the matter of allotments Canada is treated as a section of United States, and the higher the production figures the greater the quantity of material for this country. Pittsburg reports that the furnaces in that district have given a good performance during the hot weather. The falling off has been less by a good deal than is usually the case, and the men have stayed with the job remarkably well during the heated term.

Price fixing has not been altogether accomplished in Canada, although steps are still being taken to reach this end. Some time ago the War Board at Ottawa requested jobbers to give the price at which sales from warehouses were being made. This was done, and at the same time a move was made to fix a price at the Canadian mills, which, in the case of plate ran about $7.50 f.o.b. factory. The selling maximum was $10. The next step is that the jbbbers are requested to show the cost of the material now selling from their warehouses, which may have been there for some time. The jobbers are not so ready to do this. Their position is that the material they have on hand is worth what it would cost to replace it at current prices. They claim that the government is in possession of this information, and therefore in a position to know the cost of their material. The matter has not been adjusted.

Canadian dealers are having no easy time trying to enter the U.S. market for steel material in any form. It is impossible to get any promises of definite shipment. The first half of 1919 is about as close as any of the U.S. mills care to come to date of probable shipment.

The scrap situation is bad at U.S. points, and for the present it looks as though Canada were a little better off than the States. There are a number of foundries in Canada, though, that would like very much to secure an adequate supply of good machinery scrap, or anything that might be high in silicon.

There is a keen demand for supplies for shops machining shells. Some of the forgings used lately have been rather difficult in cutting, and consequently harder on the tools employed. In this connection men who have worked at shells for some years now claim that the forgings made in Canadian shops are more uniform and easier to work than any they have encountered. In fact the size of production figures and the smallness of rejections all indicate that Canadians have reached a high stage of efficiency in the manufacture of projectiles of all sorts.

COOL WEATHER IMPROVES OUTPUT BUT STEEL MARKET STILL ACUTE

Special to CANADIAN MACHINERY

MONTREAL, Que., Aug. 20, 1918.—General industrial conditions are now taking on a more settled appearance, due no doubt to the closing of the holiday season. The cool weather has also been an influencing factor in plant operation, and production figures for the past week have shown a material increase. This condition is very encouraging but business is still hampered by the inability to obtain the necessary supplies for maximum operations. Shipments of steel plates are still backward and the situation in this respect has taken on a more acute stage The old metal market has been fairly active particularly in heavy melting materials. The metals are steady without feature.

Steel Harder to Obtain

The steel situation in general is one that shows little improvement over that of the past few weeks. The regulations regarding the distribution of material are very often a puzzle to the consumer as even those in the preferred class have considerable difficulty in securing material from the mills. It frequently happens that a consumer may be given to understand that his requirements will receive prompt, or at least early attention, but when the orders are placed in the hands of the producers they are invariably advised that the quantity of orders now on the books makes it impossible to state a definite date for delivery. The filled up condition of the mills and the uncertainty of government requirements is the chief argument against early delivery. The local situation is unchanged and dealers report a relatively quiet market with quotations firm.

Steady Demand for Metals

No features of special interest have developed during the week and the market is steady in character with all quotations firm and unchanged. Dealers report a steady demand for electrolytic copper but supplies are often hard to obtain. The tin situation is still uncertain but sufficient metal is coming through to satisfy essential requirements. Other metals are comparatively quiet but the demand is quite steady. No price changes are reported.

Heavy Tool Demand Quieter

Business in the machine tool trade is quieter, the demand for the heavier tools showing a falling off. Some activity has been reported in second hand equipment, particularly in connection with tools suitable for tool room work. All supplies are very active, notably chucks, drills, cutters, etc. In general the prices are well maintained, dealers reporting a steady market.

Good Business in Steel Scrap

Apart from a steady demand for steel scrap for shell making purposes, the situation is devoid of special interest. Some foundries are having difficulty in getting sufficent steel scrap for their requirements. Some little trading has been done in machine cast scrap, but the supply of this material is almost exhausted and grey iron foundries are forced to use more pig for their operations. Local business is quiet and price quotations are firm.

DON'T LIKE METHOD OF FIXING PRICES

Dealers Claim Replacement of Material Is the Price of Present Stock

THE sale of machine tools goes in starts and pauses at present, and this week comes into the category of pauses. Shops taking on new business for the making of shells have been pretty well cared for, and if the machinery is not actually in the premises the work is well under way.

Contractors in this district continue to get good results from their shell plants. The mechanics and workers are better acquainted with the various operations now, and there is not the same period of experiment to pass through now with its delays and losses. Forgings furnished from Canadian plants are in good shape when the mills get them.

The demand for supplies is brisk, both for carbon and high speed. No new lists are out this week, and prices have remained unchanged and firm.

The Matter of Prices

The authorities at Ottawa are proceeding with their task of trying to fix prices in the Canadian steel market, but they are running into some obstacles. Critics of the way in which they are doing business are firm in the opinion that they should have definitely arrived at a fair cost before they began to set in motion machinery for fixing the prices.

Some time ago the jobbers were notified that in future they would be required to state the price at which goods leaving their warehouses were charged to the purchasers. This was complied with in most cases by the jobbers. Orders that neglected this detail were promptly returned. It is also understood that the Government at the same time took up the matter with the mills.

The latest move is that the jobbers have been requested by the authorities to state the cost price of the material in their warehouses as it is sold. This the dealers are not showing any great desire to do. In fact it is understood that several of the jobbers have sent word back to Ottawa that they see no reason for this. Their position, in brief, is that they regard their cost to be what it would need to replace the stock. In fact they hold that the replacement idea is one that is pursued and recognized in all lines of business, and they see no reason why there should be an exception made in the present case. Hence they hold that the Government from present prices will know the cost, figuring the same from the replacement price. Whether the Ottawa authorities can be brought to see things this way remains to be seen.

POINTS IN WEEK'S MARKETING NOTES

There is an unending demand for steel plates. Everything has to stand aside while material is flattened out for this work.

—

The summer curtailment of steel output is distinctly less than usual.

—

War orders that can use discard steel makes the showing of production much better.

—

The scrap situation is bad at U.S. points and its is rapidly growing worse.

—

Good results are being obtained at the shell plants in this district. This is due to better acquaintance with the work and the elimination of early mistakes and experiments.

—

Fixing prices is not proceeding smoothly in Canada. Jobbers hold that the price of material they have in stock is the figure it would take to replace the material at present prices.

—

Shipments of steel are not being promised by American dealers on definite dates. The nearest approach is "some time" in the first half of 1919.

—

There is practically no pig iron at all for users who have not a particularly strong claim regarding priority work.

—

In sheets and merchant bars, according to Pittsburg advices, the distribution to jobbers will be very light.

—

A plant which United States is building in France for relining guns will call for an investment of $15,000,000.

Shipments Are Indefinite

Deliveries are none too good just now. There is a tremendous demand for plate. In fact it seems that everything in the line of steel must be rolled into plate to conform with the enormous demand for this material in ship yards and hoiler shops. There is some interest in the demand for plate for boilers to heat the Ottawa Parliament Buildings. There is some division of opinion as to whether it is of the most essential sort or not. Some dealers are quite open in declaring that there are greater things under way now than the heating of the Parliament Buildings at Ottawa, holding that the business of the country has been carried along so far and that the same thing can probably be said of the future.

But apart from that Canadian consumers are not getting very much encouragement from Washington. In fact one letter came back to-day from a large producing company in the United States stating in reply to a query about delivery that it "might" be made in the first half of 1919. But it is not possible to hold any United States company to definite promise in the matter of delivery. They prefer to abide by the wish of the Government that they shall place their whole stock at the disposal of the Government for war purposes, and are taking the allocations of the Washington authorities as final.

Prices are holding this week at the quotations of last. No further advance is made on the lists over $8.25 for galvanized sheets, although some of the jobbers are working around the $8.50 price. Some time ago sheets for use or for galvanizing were coming into this country very freely. In fact it seemed for the time being that the embargo had simply been shot to pieces. When this condition arrived there was some of the pre-war rivalry for business, and prices came down just like they used to do. This was all very well until the report came that the shipments from the United States would be severely curtailed. Then it was that the stiffer price came. The tendency is still up.

Little Scrap Moving

There is not a great volume of business passing in the scrap yards this week, and price changes are few. A small gain is made in crucible copper and stove plate sells one dollar a ton up at $20. Makers of stove plate are actively in the market for supplies, but are not securing them in large quantities. They prefer a good line of machinery scrap, but a good many other concerns prefer the same thing just now, and there's not enough for all. In fact high silicon scrap or pig is wanted. A large radius is being covered at present in the search for all available scrap that can be located at marketable points. Some that is unearthed is at points so far from shipping facilities of easy access that it is hardly commercially possible for present use.

No Outstanding Orders

Machinery and machine tool dealers, as well as those handling supplies report fair business, especially the latter. Some of the shells that have been forged in the United States have been much harder than the ones made in Canada. They are harder to work, and hence harder on machine tools, especially high speed. Demand is good for high speed lines, and stocks are rather depleted at some points. In fact there is some Montreal business being handled right now in Toronto because of this fact. The lists that have been used as the basis for some time are till regarded as correct, and no immediate changes are in sight.

Prices Stand Here

No changes are noted in the market prices for non-ferrous metals. Despite the scarcity of tin, a certain amount of it arrives in the local market at intervals, of course all coming through the English ports. Price advances do not retard the amount of business being handled. One dealer in a large way stated to CANADIAN MACHINERY this morning that in the case of copper this tendency had been noted recently. The United States Government raised the price. The dealers raised their price to the new figure. The trade paid it and passed it along, until it reached the last man to buy, and he paid the thing and absorbed it. The amount of business was just the same at the higher price as at the lower.

U.S. TO BUILD PLANT IN FRANCE TO FIX GUNS

Large Outlay to Be Made for the Work in Connection With Relining

Special to CANADIAN MACHINERY

NEW YORK, August 22.—Government purcrases of machinery of various kinds continue to monopolize the attention of manufacturers and dealers in all sections of the country. It is estimated that the business now being placed and pending calls for the expenditure of $30,000,000; half of this sum is required for the tools to be installed in the gun relining plant that the United States Government is building in France.

The cost of its construction will be about $30,000,000. Notice of this project was first given by CANADIAN MACHINERY several months ago. In the last week, the Chief of Ordnance of the War Department announced the completion of plans for this great plant. Large orders have already been placed for rifling machines, for gun-boring and engine lathes and for grinders. Locomotive shops that are also being built in France by the United States Government are being equipped with tools made at home. The Director of Military Purchases for Railways is now buying many cranes for these shops and is also buying $1,000,000 worth of tools.

More New Business

The War and Navy Departments continue to give out new contracts for guns and shells, most of which are going to manufacturers in the Central West, but some orders in the past week have bene placed with Eastern shops and notwithstanding the Government orders creating a barred zone in the East, in some cases Washington authorities are giving permits to extend manufacturing plants working on Government contracts. The Ordnance Engineering Co., New York, which is to manufacture a new type of star shell, has bought automatic screw machines and other equipment for this purpose.

The American Radiator Co. has received a contract for 4.7-inch and 155 mm. gas shells which it will manufacture at its Buffalo plant. For its gun plant at Bayonne, N.J., the same company has bought a large number of tools to increase output of naval guns. The Batavia Steel Products Co. is producing 75 mm. shells and the J. J. Carrick Incp., an affiliated concern, is making 155 mm. shells at its Buffalo plant. The shell making equipment for these two works have been bought in Canada. In this connection, it is interesting to note that the Leaside Munition Co., Toronto, Ont., which recently received a contract for 12-inch shells from the United States Government, is spending $3,000,000 for an addition to its plant to execute the United States order. The shells will be forged and machined.

Other Large Orders

Several large companies in the Chicago district, it is reported here, are negotiating with the Government for the manufacture of 155 mm. guns and projectiles. The Crocker-Wheeler Co., Ampere, N.J., manufacturers of motors, generators, and other electrical equipment, is now utilizing 75 per cent. of its capacity for making radio equipment and other electrical apparatus for the United States Government. Work is being rushed, the plant operating a twenty-four hour schedule.

Besides the Wright-Martin Aircraft Corporation and the Pierce-Arrow Motor Car Co., manufacturers of automobiles are turning to the production of air motors and aircraft accessories. The Locomobile Co. of America, Bridgeport, Conn., is building a new shop for the manufacture of motors to equip armored tanks. The H. H. Franklin Manufactur-

PRODUCTION OF PIG IRON RESTS ON INCREASING OUTPUT OF U.S. COKE

ONE of the biggest questions that is now facing United States is the increasing of the supply of pig iron. Behind this, of course, is the matter of securing enough coke to do it with, and back of coke lies the matter of increasing the mined quantities of coal. There is no use talking of increasing plant capacity even for war work until these matters are first attended to, because the limit to everything is the limit of the furnaces. The supply allotted to Canada will not increase until the total output is increased at production points across the line.

Reports concerning the situation in United States for the present week are as follows:—

Cleveland.—Heavy demands still continue to be made for iron allotments here. Foundry men are figuring heavily in these requests. There is an uncertainty which is becoming quite marked in regard to supplies for the future, owing to a number of the furnaces changing over to basic, and the claim is made that some of the essential contracts will be held up by this reason. A delegation of foundrymen will lay the matter before Washington, and ask for some change in the regulations, or as an alternative put it up to the government authorities to allocate to them enough iron to keep up with their work.

Boston.—Some of the foundrymen report liberal deliveries of coke, but the same cannot be said in regard to iron, There has been no time in the past two years when any of the foundries in this district had an oversupply of iron.

New York.—There is a large amount of trade moving, but it is strictly of the immediate need variety. Very little business is booked for first half delivery in 1919, and even these orders are made conditional upon the needs of the government, which sees to it that every order let out is tied up good and tight to the war game.

Philadelphia.—Reports here indicate that some 1919 business has been booked, on the basis of furnaces taking care of old customers. Only a few of the Pennsylvania furnaces participated in the business.

Pittsburgh.—The hot weather that has now run into quite a stretch has succeeded in "getting" some of the furnaces, and figures will show that there has been a dropping off at some of these that will run from 30 to 40 tons per day—not much in one place, but when it is kept up many days at many places the aggregate will be considerable. August figures, from this prediction, are likely to show a rather sharp decline. Reports coming in from some of the centres in this district state that the supply of coke is such that it is actually curtailing operations.

Buffalo.—Inquiries for pig iron around here are so heavy that it is quite certain that nothing much will be exported from here for some time to come. Very few contracts are being made, as there is a tendency to let the government officials look after the allocating of the furnace output.

Youngstown.—It is reported that some finishing mills here are down this week because there is not sufficient bessemer capacity to supply them with bars. The shortage of pig iron is affecting a number of the plants here.

Chicago.—If an old customer is known and can certify that he has government business well into 1919 that will guarantee his consideration in the pig iron market and there is some chance of him being entertained by the furnace agents. Otherwise he can get no definite promises. In fact the taking of contracts is being discouraged until the situation becomes very much clearer.

Cincinnati.—Encouraging reports continue to come in regarding the manner in which the men have stuck to their work during the hot weather, and in consequence production has suffered little here. Basic and malleable makers receive close direction as to the distribution of their output among the melters on government work.

ing Co., Syracuse, is buying additional equipment for the manufacture of crank shafts for Rolls Royce airplane motors. The Willys-Overland Co., Toledo, is also preparing to add to its motor-making equipment. These purchases have naturally followed the advice from Washington that automobile manufacturers should utilize 100 per cent. of their capacity for war work, thus eliminating the manufacture of pleasure automobiles entirely.

Activity continues among manufacturers of cranes. The largest list for cranes put out in the past week came from the Air Nitrates Corp., New York, which is building two plants, one at Toledo and the other at Elizabethtown, Ohio, for the manufacture of nitrogen by atmospheric fixation. Specifications for 18 cranes have been put out. The Thompson-Starritt Co. has purchased 89 chain hoists through J. N. Kinney, New York City, to be installed in the Government powder plant at Charlestown, West Va.

THE SCRAP SITUATION IS BAD AND GRADUALLY GROWING WORSE

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Aug. 22—Production of steel ingots in July was at the rate of about 42,250,000 gross tons a year representing a decrease of almost 3 per cent. from the June rate. This was the first decrease since January and it was a much smaller decrease than usually occurs in July. The first fortnight of August witnessed exceptionally hot weather, and this month's output is likely to show a further decrease, but on the whole the steel trade is well satisfied, the summer curtailment being distinctly less than usual.

A little information leaked out recently which indicates that the proportion of finished roled steel to ingot production is running a trifle higher than normal, this being doubtless due to the small scrap loss involved in rolling shell steel. Earlier in the history of shell steel manufacture there were particularly heavy scrap losses, but the scrap losses are now less than is the case in the rolling of the average finished steel product, due to greater skill in manufacture, to the fact that shell steel is running much more to large sizes than was the case in 1915, and to the efficient manner in which the War Industries Board has picked out war orders that could well be filled by using discard steel. As details of the various articles and implements that are used in the war are not given out it is impossible to particularize as to what is being rolled for war purposes from shell discard steel.

Using the proportion indicated, it appears that when the steel industry is making ingots at the rate of 43,000,000 gross tons a year it will be making finished rolled steel at the rate of about 38,000,000 net tons a year. It is regarded as conservative to estimate the ingot output in the present half year as at this rate, for while July and August fall slightly behind this should easily be made up when cooler weather arrives. Thus there is a reasonable expectation that 18,000,000 net tons will be made in the half year, this comparing with the observation made a few weeks ago by the War Industries Board that the production of more than about 16,500,000 tons could not be counted upon. The board was estimating the requirements at 20,000,000 or 21,000,000 tons, and later in a statement to the Fuel Administration, calling for a full supply of coal for the steel industry it put the requirements at 22,000,000 tons.

The Shortage of Scrap

It is true that 43,000,000 tons of ingots does not represent the capacity of the industry, as computed for normal times, but rather about 90 per cent. of the capacity. On account of various difficulties, however, easily the chief being the shortage of scrap, the steel making facilities cannot produce their normal tonnage. The scrap situation is bad and growing worse. The shortage, of course, is due to the peculiar nature of the industrial and other operations now being carried on, which are such as to bring out very much less than in normal times. The railroads are wrecking very little rolling stock, scarcely any bridges or buildings are being torn down and there is little new scrap being made. Even the shell factories are producing much less scrap than formerly because they are making shells in a different manner.

An important meeting is being held in Washington this week between J. Leonard Replogle, Director of Steel Supply, and the special sub-committee of the American Iron and Steel Institute, composed of Messrs. Gary, Farrell, Dinkey, Topping, Clarke and Grace. All that is given out definitely is that the meeting is a very important one and has to do with steel supply. The inference is that it has to do with the project, discussed at some length in this report of a week ago, of increasing the output of steel by new construction. What would be required would be additional blast furnaces and open-hearth stel furnaces, as enough coke and ore could probably be provided, also enough steel rolling and finishing capacity. With supplies of material, labor and transportation facilities limited by the heavy demands in so many directions, the question is whether such new construction would be advantageous.

Freight Movement

The monthly report of ton-mileage on the railroads for May does not make a favorable showing, comparing the figures for May with those for the preceding month or with those for May, 1917. Part, but perhaps all, of the deficiency is due to the adoption May 1, 1918, of the universal interline waybill, whereby more freight than formerly that started on its journey in May did not get into the statistics, but will lap over into June. The figures indicate that last May freight was moved at the rate of 418,000,000,000 ton-miles a year, against rates of 448,000,000,000 in April and 439,000,000,000 in May, 1917. Apart from the disturbance caused by the new waybill, other items in the monthly statistics seem to suggest that the railroads did not improve their service in May. In the fiscal year 1913, the best year before the war, the ton-mileage was only 301,398,752,108, so that on the whole the railroads have been doing extremely well, except in December, January and February.

Scarcity of Pig Iron

It appears that every ton of pig iron produced must be made to do its full duty in serving the more essential industries, and allocations in favor of plants engaged in the most important work are so heavy and so hard to meet that there is practically no iron for consumers who do not have a particularly strong claim upon it. Allocations since May 1, for the industry as a whole, total about three-quarters of a million tons. This figure becomes more impressive when it is noted that the total production of pig iron by merchant furnaces is only about 900,000 tons a month, the remaining output being by steel works whose iron is rarely if ever touched by allocations since they already use using it in war work, and when it is noted further that the merchant furnaces are all working under the preference schedule, which would in general make the iron go to the right place without allocations. Thus between 20 and 25 per cent. of the make has been allocated when the furnaces were already filled with orders and were endeavoring to distribute their output to the best advantage according to the standing their various customers had on the preference list.

Steel Products

The great majority of steel consumers are receiving fairly good deliveries of finished steel products, because they have converted their operations into war work. Those whose operations entitle them to no preference are receiving scarcely anything. They are given the consolation that they should seek war orders. That would entitle them to steel if there were any, but it would not automatically increase the supply from which the steel shipments would have to be drawn.

The pipe mills expect to make a fairly good distribution to jobbers under the instructions issued last month, and the distribution of wire products will be fair. In sheets and merchant bars the distribution to jobbers will be very light.

Tin plate production in July was over 3,100,000 base boxes, easily a record for July, when there is usually a sharp curtailment in output on account of the heat. Production in the first six months of the year was about 17,250,000 boxes.

THE COAL SITUATION IS STILL A VERY SERIOUS ONE IN THIS COUNTRY

Special to CANADIAN MACHINERY

SYDNEY, N.S., August 22. — The workmen of the Dominion Iron & Steel Company in Sydney have for a third occasion absented themselves from work on Sunday, and as a result the operation of the plant has been hindered during the current week and its production much lessened. No action has yet been taken by the government in the matter, although it is understood that Senator Robertson and A. K. MacLean are being despatched from Ottawa to look into the situation. It is believed that a more serious state of affairs is impending, and the apparent inaction of the government is giving rise to unfavorable local comment.

The wage adjustment between the A. M. W. and the Dominion Coal Company affecting both the Glace Bay and the Springhill Collieries has been satisfactorily agreed upon between the parties. The wage contract between the coal companies and the A. M. W. of Nova Scotia expires at the end of 1918, and it is expected that negotiations looking towards a new arrangement will shortly be commenced.

Will Make Coke

The first block of the new coke ovens built for the Dominion Iron & Steel Company at Sydney are now being heated preparatory to commencing coking operations, and it is expected that coke will be made within the next few weeks. The second block of ovens will be a month later in commencing to make coke. The installation of a light oils recovery plant is also being undertaken. Work is proceeding on the installation of a new Baum washer. This type of washer is designed to give a washed coal very free from excess moisture. The new coke ovens are the most modern type, and have an extremely rapid coking capacity. The reconstructed No. 1 blast furnace is also practically ready for operation. The combination of a washed coal free from excess moisture, the new coke-oven plant, and the re-constructed blast furnace is expected to ensure a regularity of operation that will result in a much larger yield of steel of uniformly good quality.

To Increase Production

It is anticipated that within a few weeks the plant will be producing up to 36,000 tons of ingot steel per month, and that greater tonnage records will be obtained than previously in the history of the steel plant. It is therefore to be hoped that labor disputes will not interfere with the consummation of a policy that has entailed the expenditure of large sums of money on capital extensions and repairs. It may be noted that these expenditures have been made out of revenues, and that so far the shareholders of the steel company have not benefited by any increase in the dividend payments. At the same time the increases in wages to the employees have totaled from 70 to 100 per cent.

Reliable Confirmation

An authoritative confirmation of the statements made in this letter regarding the coal situation has been issued by the President of the United States, who makes the pregnant announcement that the danger arising from the scarcity of coal "is the most serious which confronts us." The statement could scarcely be graver in its import, or more comprehensive, and we have not been accustomed to regard the President as given to overstatement. It is surprising when such eminent leaders as Lloyd George and President Wilson express themselves so definitely in regard to the importance of coal supply that the action of the Allied governments should have been so indefinite and purposeless in so far as the production of coal is concerned. There has been an entire misconception of the problem, as the very title given to the fuel controller discloses when the purport of that title is analysed. In considering the problems of fuel distribution and the controlling of fuel prices the public and the officials of the government charged with these duties have overlooked the main problem, namely the question of production.

A Great Big Problem

In modern warfare coal is the beginning of all things. The authorities have looked upon coal supply with the eyes of civilians; they have failed to comprehend its prime military importance. They have confused coal mining with other commercial industries. In our letter of the 4th July we stated that "to those who know the situation, the problem of coal production is not the least among the problems that face the allied leaders. If the coal production declines to a point where it restricts the output of munitions and the transport of troops, the gravity of the situation will appear in its true light, and things are approaching such a point." President Wilson now says: "Without an adequate supply of coal our war programme will be retarded; the effectiveness of our fighting forces in France will be lessened, the lives of our soldiers will be unnecessarily endangered and their hardships increased, and there will be much suffering in many homes throughout the country during the coming winter." The writer ventured to predict that the grim actualities of war will compel that the needs of the army and navy shall come before the requirements of the people at home, and that if these activities were threatened the people at home would have to freeze. President Wilson does not say exactly this, but it is what he desires should be inferred from his words.

An Essential Industry

The authorities should cease to concern themselves with the questions of price fixing, with the supposedly high wages earned by the miners, and other secondary questions, and should approach the problem from the standpoint of increasing by every possible means the production of the most important munition of war, that munition which is the genesis of all others, and failing which, every wheel of the machinery of war and industry stops. Coal is basic, primal, fundamental. It is like the ignition spark to the gasoline engine. Without it the machinery is dead.

President Wilson is once more to be congratulated inasmuch as he has made clear to the allies, in a few pregnant sentences, that which others have been preaching in season and out of season for the past four years. He has removed the mask of misrepresentation, misunderstanding, ignorance and bias that has surrounded the matter of the coal supply, and when he announces that the danger arising from the present coal scarcity "is the most serious which confronts us," he states the exact precise truth. It is to be hoped that his diagnosis of the problem will be followed by the application of proper remedies, at least so far as Canada is concerned.

NOT ENOUGH SCRAP MATERIAL COMING TO SATISFY DEMAND MADE FOR IT

Pittsburg—Heavy melting steel guaranteed low phosphorus scrap and heavy shell turnings are in especially strong demand here. Railroads are assisting as best they can in the search for scrap and will aid in the movement of securing it by having cars in readiness for quick shipment. Although good tonnages have been secured in this way they have not been of sufficient size to make any great impression on the market.

Chicago—Scrap dealers here report that their books are still filled with orders that have been taken some months ago. In fact they have more contracts on hand than there is any chance of their catching up with. Cast scrap is in great demand and the supply is small, while re-rolling rails are practically unobtainable and such tonnages as appear in frequently are placed immediately.

New York—The somewhat cooler weather that has been prevailing the last few days has enabled the scrap yards to work at greater speed than for some time past. Even allowing for this though, the turnover in the yards is not near the capacity of former years.

Buffalo—There are no indications here of the demand for scrap metals letting up. The demand is not confined to any one particular line, but it may be quite correctly stated that the buyers are in the market for everything that the dealer has. Cast scrap is in a very strong position just now, along with every heavy grade. Buyers from other districts that usually do not come here for supplies are reaching out into the Buffalo market, but the car shortage does ont give them much encouragement of success.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton		.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	125 00	125 00
Spelter	11 00	11 00
Lead	10 50	10 00
Antimony	15 50	18 00
Aluminum	50 00	58 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Effective Feb. 5, 1918.

Standard Buttweld

Per 100 feet	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 16	7 29
⅜ in.	5 16	7 29
½ in.	6 55	8 12
¾ in.	8 28	10 41
1 in.	12 24	15 39
1¼ in.	16 56	20 82
1½ in.	19 80	24 89
2 in.	26 64	33 49
2½ in.	42 72	53 53
3 in.	55 85	70 00
3½ in.	70 84	87 86
4 in.	83 93	104 10

Standard Lapweld

2 in.	$ 29 60	$ 36 08
2½ in.	44 46	54 70
3 in.	58 14	71 53
3½ in.	72 68	90 62
4 in.	86 11	107 37
4½ in.	97 79	122 56
5 in.	114 00	142 82
6 in.	147 80	185 28
7 in.	192 80	241 57
8 L in.	202 50	253 75
8 in.	233 30	292 32
9 in.	279 50	350 18
10 L in.	259 20	324 80
10 in.	333 70	418 18

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES

4" and under, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	25 50	24 50
Copper, heavy	25 50	24 50
Copper, wire	24 50	25 50
No. 1 machine composition	23 00	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	26 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs	9 00	8 50
Cast borings	12 00	12 00
Stove plate	26 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	8 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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 70
Premier, 10¾ oz.	.....	10 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	37½
Disston	50
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod.	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

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AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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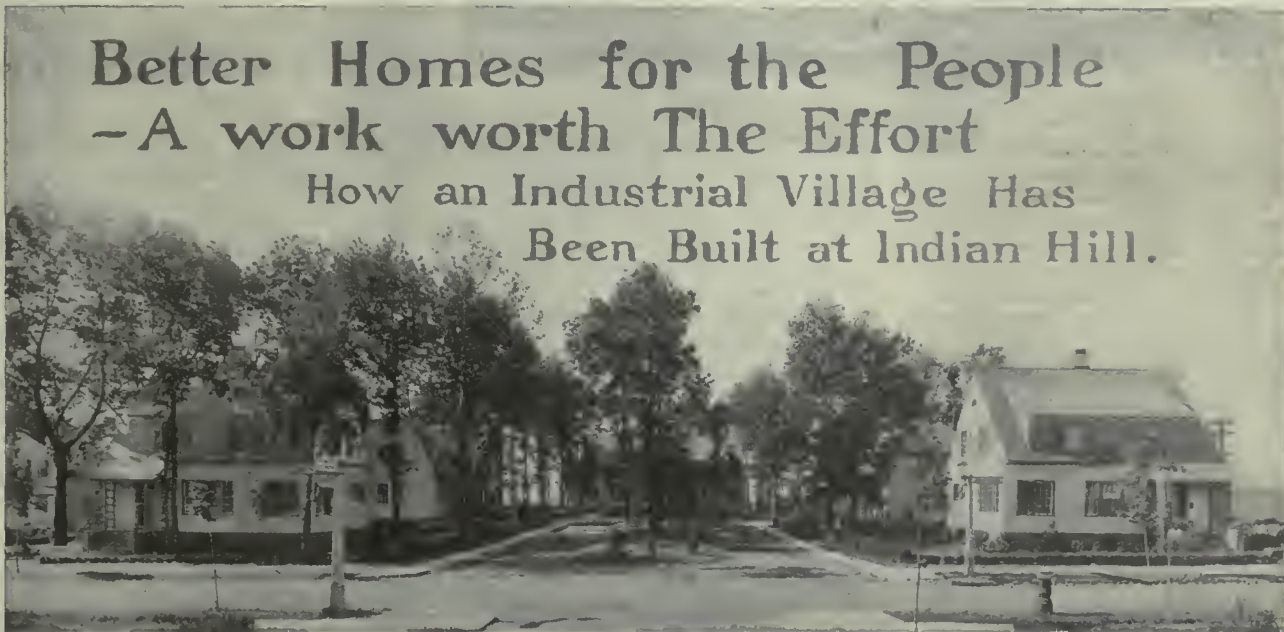


By Charles C. May

DESCRIPTION of the settlement which the Norton Company of Worcester, Mass., is building for its employees might well take for its text, "A city that is set on a hill cannot be hid." Certain it is that if the development is successful, its attractions will become a beacon to the countryside for miles around; if it should fail in any considerable degree its shortcomings will become a lesson that he may read who runs anywhere in the vicinity.

This means that Indian Hill is the possessor of a most commanding site. Removed by several miles from the heart of the city of Worcester, lies Indian Lake, a sheet of water of perhaps a mile and a half in length by half as much in width. Its banks have not, as yet, been reached by indstrial development and lie happily unspoiled—a challenge to the city of Worcester for appreciation and preservation.

Indian Hill itself—the "thirty acre tract," as it has been named during the development—occupies the lofty ridge that thrusts its point out toward the head of the lake. Before it lies the open country in opulent variety in all directions, to the limits of perhaps 300 degrees of the circle. Holding the northern end of the lake, the major part of the hillside slopes toward the south, with the higher wooded areas at its back for buffers against the north winds. This is a detail of not merely sentimental value, for in these latitudes the land of extended outlook is also the land of bitter-cold blasts.

ILLUSTRATION SHOWS ELEVATION OF HOUSE OF TYPE N2.

Back from the north-eastern corner of the lake and within the angle between the main railroad and its branch lies the plant of the Norton Company. Primarily for the adequate housing of these men and their families was formed the Indian Hill Company, a subsidiary of the Norton Company, entitled under the Massachusetts laws to acquire, develop, and dispose of real estate. It is accordingly the Indian Hill Company which has brought together and is now engaged in developing holdings of some 116 acres, of which Indian Hill proper forms the first demonstration. The development, we have said, is primarily to provide adequate housing for its employees, with a view toward individual ownership, permanency

GROUP OF HOUSES, INDIAN HILL DEVELOPMENT.

and contentment in employment, and resultant general efficiency. In these objects the company is self-seeking only in the same degree that the word might be applied to those others of its institutions for the office workers—the auditorium, the gymnasium, the rest-periods, the hospital, the tennis courts, to name some of them at random.

Secondarily, and in no sense selfish, was the company's hope that in wrestling with their own housing problem they might at the same time make some contribution toward the solution of the wider problem of workingmen's houses in general and toward the suppression of that pest of Massachusetts—the wooden three-decker. It is an outcome devoutly to be wished.

One cannot be too thankful that Indian Hill did not belong to one of those communities where the ruling of a standardized street system reigned supreme. Had it been so their engineers would have done exactly what New York's did to Manhattan Island—they would have laid down on the map of Indian Hill a gridiron of rectangular streets that had no respect for height nor depth, that recognized no main artery where traffic would naturally congregate, that had no eye for a magnificent view, that could afford no resting point with an outlook toward the sunset. Is it inconceivable that anything so inflexible and utterly devoid of imagination could happen to a spot like Indian Hill? Yet, remember that in 1807, when New York's plan was concocted, the Island of Manhattan above Chatham Square lay as virginal and as unstandardized as is Indian Hill to-day.

The Community Plan

The plan that has actually been worked out by Grosvener Atterbury of New York, town planner for the development and architect for the houses, is the result of careful study of all the conditions. It seeks to secure the best possible grades for the main circulation roads, and only slightly steeper for the minor, non-traffic ones; it shows deference for the natural features of the site in conformation woodlands, view and exposures; it seeks to provide quiet bypaths away from the lines which will one day be thronged with streams of traffic, in order that in these spots may always be preserved that domesticity, intimacy, and hint of aloofness that belongs rightly to cottage surroundings.

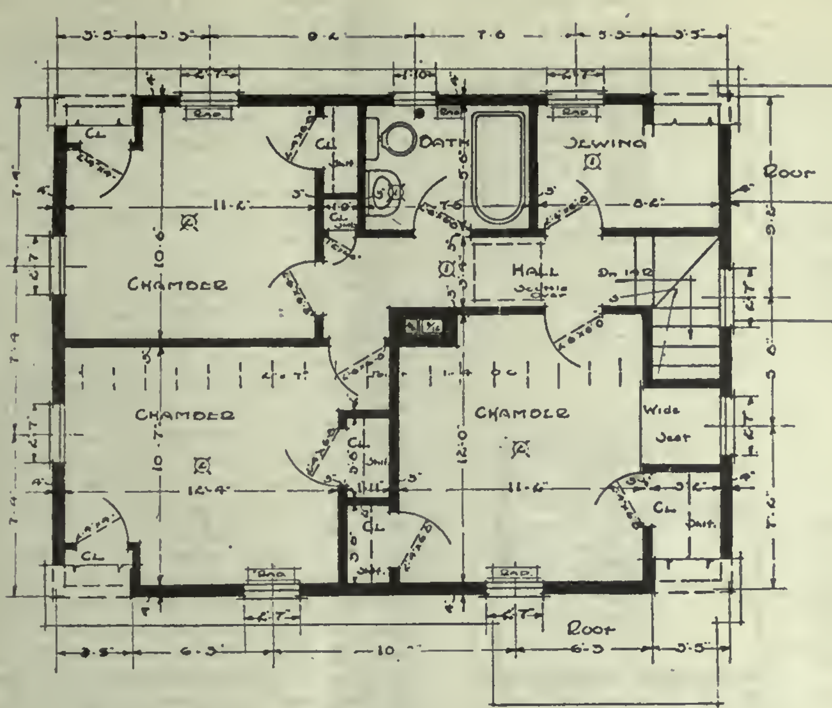
The main lines for traffic, as projected, are Indian Hill road and the street that climbs up the shoulder of the hill after crossing the railway cut and circling in a double sweep to enter the Community Center from either side. This latter approach anticipates the creation of a shore drive which, it is to be hoped, will some day skirt the edge of the lake, where it would form a connecting link between the areas on the east and west. A cross connection of some sort must in the future become immensely valuable, since the steepness of the slopes prohibits any other east and west link within a reasonable distance. This shore drive would furthermore preserve the banks of the lake to the city for all time and prevent private exploitation in a manner that might injure the entire section. And, to put the aesthetic element last, as the town planners have fallen into the habit of doing, this shore drive has the possibility of becoming a feature of very great charm, one that will attract to the region a considerable and desirable volume of motor and other traffic.

The community center is placed at a point which combines the geographic location needed for such a gathering place, with other desirable elements. It holds the salient point on the shoulder of the hill, where grades are least difficult to manage; it will witness the passage of nearly all the through travel of the section; it commands a magnificent view, which should in itself prove a magnet to attract the strolls of the villagers. To enhance the charms of this outlook the side of the square toward the lake will be left open and treated as a public terrace. Footpaths will also be brought down the steeper slopes of the hill toward the center in order to provide easy crosscuts and thus make it readily accessible for pedestrians, shoppers and strollers.

The secondary streets are, in the majority of cases, contour roads. Looked at merely as a paper plan, the layout is definitely lacking in cross connections. But, studying the topography, one realizes that gradients so steep as these would be impossible for any but travel on foot, and that to create roadways suitable for vehicles would entail expenses quite prohibitive in a development of this character. The footpaths just mentioned are therefore by way of a compromise to break up the long blocks.

When it was first proposed to develop the lovely little grove which is now Nashoba Place in the manner of a close, it was an open question whether or not such an arrangement would appeal to the American tastes. Experienced real estate men have told us repeatedly: "First of all, give each one his full share of frontage on the building line. The American loves his look at the asphalt." Mr. Atterbury had faced this situation before in the planning of Forest Hills Gardens. There, despite pessimistic views as to American discrimination, groups involving so-called "rear" housing units were liberally used, but with some fear and trembling for the outcome. Actually, the very first sale was a house that had greater setback, less

GROUP OF HOUSES, INDIAN HILL DEVELOPMENT



SECOND FLOOR PLAN, HOUSE OF TYPE N2, INDIAN HILL, GROSVENER ATTERBURY, ARCHITECT.

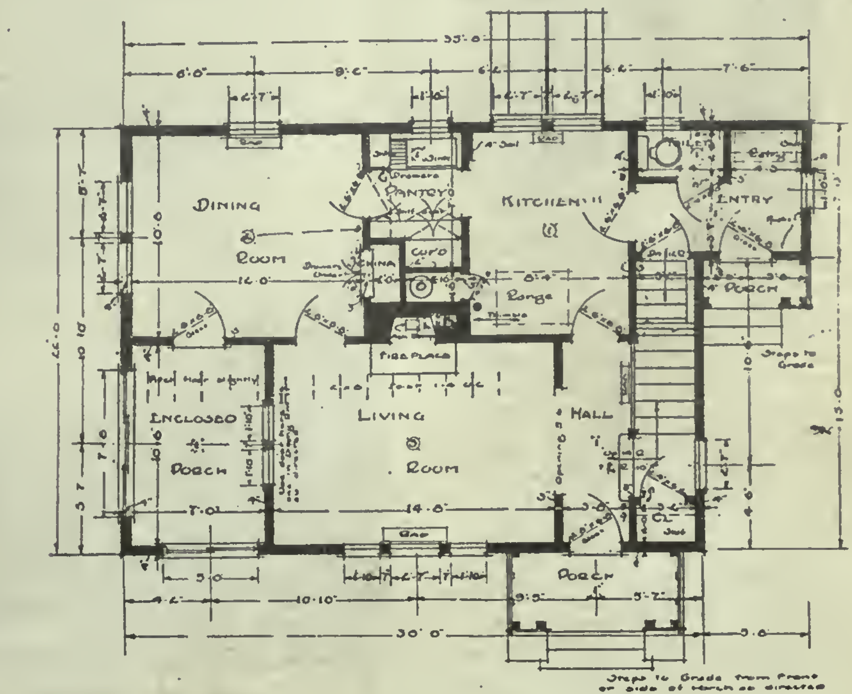
view of the asphalt; from that day on there has never been a doubt of the saleability of grouped units in Forest Hills.

At Indian Hill the question was reopened in a development of a different character. Here the provision of public amenities was to be more limited, the cost of private houses far less, the whole project more circumscribed by financial limitations. Yet here, too, where the very modest little house could rely upon little landscaping or "trimmings" to dress it up, the result has been identical with that in Forest Hills. Faith has been justified in believing that in most cases the buyer (be it of a house to cost $3,000 or $10,000) needs only to be shown. True, he lacks usually in both cases the imagination to see it for himself, exactly as he lacks the training to read an architectural elevation, but given some one to put the demonstration on the ground before him, and perhaps to explain a few of the whys, he is by no means slow to grasp the truth and to act upon it. Nashoba Place has accordingly been successful from the first; fully occupied, tastefully planned, delightfully sheltered, it already has some of that quality which, a few years ago, one sought vainly in this country and found only by travelling to England or Germany.

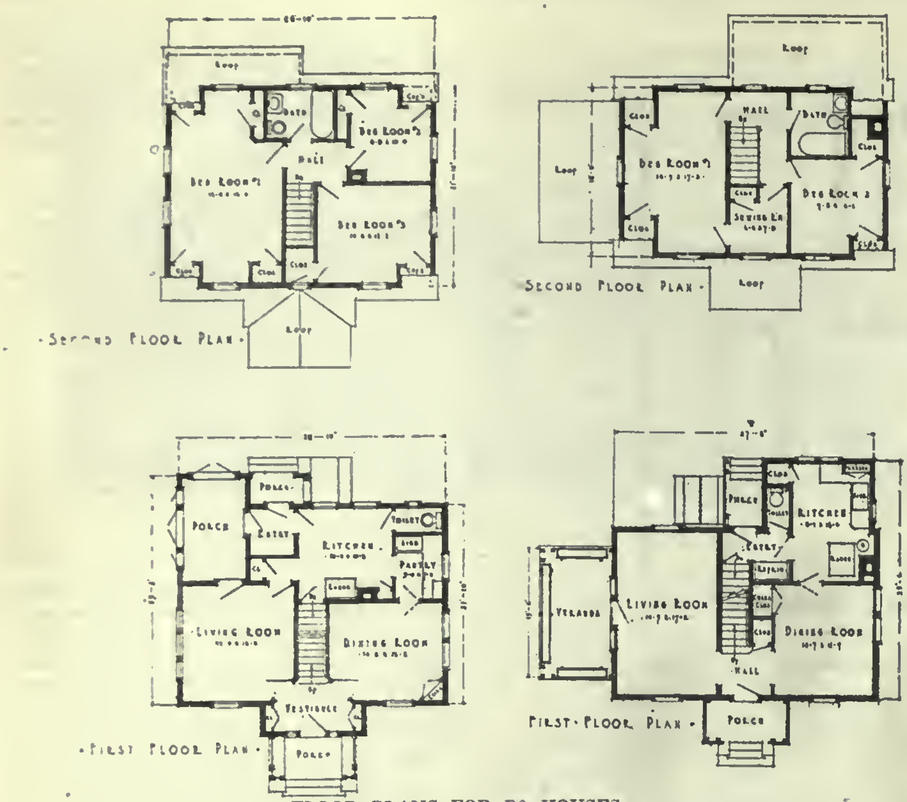
Construction work at Indian Hill has heretofore been confined to dwellings—some fifty-eight of them, built in two operations during the summers of 1915 and 1916. Enough has been done to give a suggestion of the ultimate look of the town—white walls seen among the trees, roofs grey green to unify the composition. The white was selected because of its consistency with New England traditions, because of its effectiveness, viewed from close at hand or from a distance, and because, unlike any other color, it can be repeated in a great number of cases without becoming tiresome (witness the delightful village of Whitinsville, also in Massachusetts). Slate was chosen for the roofing material because of its economy, its fire-resisting qualities, and because the color is good in itself. The roof material is the same throughout, as we have said, to bring unity into the composition. Where a collection of houses can be seen all together and from a distance, this common bond between the individual units is of the greatest value; it is like the family resemblance that marks them all one kindred; it is like the soldier cap that transforms the gang of boys into a regiment. Only by this and similar evidences of collective planning can there be produced dignity and carrying power in an aggregation of which the units, taken singly, must be too small or too insignificant to be effective.

This problem is peculiarly pressing at Indian Hill, since the number of buildings other than tiny cottage units, is at a minimum. For, by a curious psychological kink, the grouped party-wall dwellings that are the rule in English garden cities that are eminently successful at Forest Hills Gardens, are usually rejected with scorn by the industrial worker. He pridefully insists that his dwelling (to cost one-third as much as those, for example, at Forest Hills) shall be placed on its own lot, with free spaces all around, and shall be guarded to the last foot from any loss of power in its proclamation of individual ownership. Even the two-family semi-detached house, although planned to give perfect privacy, exposure and open spaces, does not as yet appeal strongly to the buyer, except in special circumstances of relationship or a David-and-Jonathan intimacy between two families.

Further development will, of course, work vast improvement in that there are already provided site reservations for several buildings of adequate mass in different sections of the property. There is the dining hall at the front of the streets as one enters Indian Hill from the plant; the Satucket Inn, really an exalted boarding house for bachelors, embodying the features of a club; a similar institution for the bachelor girls of the office force, a chapel, a recreation hall. Considering that these are quite apart from the buildings that will form the three-sided enclosure of the community center, we may feel that the amount of reservation for larger buildings is generous enough to go far toward



FIRST FLOOR PLAN HOUSE OF TYPE N2, INDIAN HILL, GROSVENER ATTERBURY, ARCHITECT.



FLOOR PLANS FOR D3 HOUSES.

overcoming the handicap of the minuteness of the individual units.

When the time came for naming the streets, the cue from local tradition was obvious. Upon Indian Hill, at the head of Indian lake, one would hardly impose an assortment of Broadways, Main streets or Grandviews. On the other hand it was comparatively simple to find Indian names which would respect tradition, sound well, and at the same time possess some distinction of their own. The first selection of names proved that the danger of a little knowledge was no more absent from this than from other pursuits. An expert Indian lore, called in to viser the list before final christening found that half the names were distinctly applicable to the ocean and its shores. This naturally demanded revisions in which "Big Wave," "Long Beach," and the like were exchanged for names which signified "Great Oak," "Open View," and so on.

In a countryside as open and unrestricted as in Indian Hill to-day, it would not be surprising if it were difficult or impossible to prove to the promoters the wisdom of large reservations for park areas. Fortunately this has not been true. It is the policy of the Indian Hill Company to preserve generous tracts of high, wooded land as a playground for the villagers; certain parts of the lake shore will doubtless be developed for bathing, boating, and water sports, and over along the east base of the hill will be the general recreation center. A comparatively slight amount of modeling will make the side hill into a natural amphitheatre, before which will be spread out the baseball field, the running track and their adjuncts.

Beside park areas for the general public, serious consideration is being given to the question of providing small parks in the interiors of various blocks as a play space for the children from the homes surrounding.

The numerous advantages of this system—safety, accessibilty, economy of land value, ease of supervision—are all so familiar and so generally recognized that comment is uncalled for. One special feature might be noted, however; as an exceptional opportunity. The higher portions of Indian Hill contain several excellent springs which, unused, might become troublesome. They must be controlled by piping into the storm sewer. To do this and nothing more would appear to be neglecting a splendid opportunity. Piped into the private parks, springs would, for a ridiculously small outlay, afford the bit of quiet water that would be the completion of the picture, the final element of charm usually left out in such cases because too expensive. The older boys and girls can swim in the lake; here the younger children could wade and splash and have a generally wonderful time. For their sakes, if for no other reason, the springs should not be consigned to waste their streams of pure water forever unhelpfully into a sewer.

Certain parts of Indian Hill are beautifully wooded; there are several fine specimen trees worthy to form landmarks; elsewhere the planners have started to make good any tree deficiencies. Not only have they adopted a programme for tree planting along the highways, but included in the purchase price of every house is a small amount representing the begining of a landscape treatment for that particular lot. The amount is small because the operation is a wholesale one; the results have a unity and breadth of scale which would be impossible were the planting left to individuals. This is by no means a criticism of the individual enterprise and taste of the owners; it means simply that in this department, as in others, the advantages of collective planning are apparent.

Buyers at Indian Hill have every reasonable assurance of the stability of their purchase. They know of the substantial materials that have been built into their houses (brass supply piping and copper flashings are not used by the jerrybuilder), and they know that no man can plant next door a factory or a store or a saloon. In other words, the property is all sold under carefully considered protective restrictions, which are accepted and recognized by the purchaser as equally valuable to themselves as to the company.

Terms of Purchase

The Indian Hill Company requires from the purchaser an initial payment of a certain per cent. of the purchase price, whereupon a conveyance of the property is made. For the balance of the purchase price the purchaser gives two notes, one

STREET SCENE INDIAN HILL DEVELOPMENT

for $1,000 payable in twelve years at 5 per cent., and another for the balance of the purchase price payable on demand, with interest at 5 per cent., both notes being secured by a purchase money mortgage.

The purchaser gives also a supplementary agreement to the effect that he will purchase in a co-operative bank five shares, and will continue payments thereupon until his deposits shall have matured in the sum of $1,000, which in local banks, at the prevailing rate of interest, takes place in about eleven years and ten months. This insures the payment of the twelve-year note according to its terms. It gives the purchaser a feeling of independence, inasmuch as he does not make periodical payments on the principal to the company, and enables him to become acquainted with co-operative bank methods.

In consideration of this agreement the company agrees not to make demand upon the demand note as the purchaser shall continue to make monthly payments in accordance with his agreement to the co-operative bank. The company further agrees that if he shall die or become incapacitated within twelve years —provided that at the time he shall not be over sixty years of age—it will accept the surrender value of his co-operative bank shares in full payment of the time note. The result of this agreement is that the purchaser may be assured that at the end of twelve years, or upon his prior death, a sufficient proportion of the purchase price will have been paid so that he or his estate will then own the property free of all encumbrances except a first mortgage for not over sixty per cent. of the value of the property so that at his option he may resort to a bank for a mortgage and be entirely independent of the company.

The company gives each purchaser a schedule showing the required monthly payments. The following table is a reproduction of one which was given to a purchaser of one of the 1915 houses, and illustrates very well the method of financing the purchase of an Indian Hill house:

Your total purchase price is	$3,851.50
You have made a first payment of 10%	385.15
You are borrowing on mortgage the balance ..	3,466.35
The amount due in 12 years, secured by time note, is	1,000.00
The balance secured by demand note is	2,466.35
Your monthly interest during first 12 years will be	14.45
Your monthly payment to co-operative bank will be	5.00
Your total monthly payments during first 12 years	19.45
Your monthly interest payment after 12 years will be	10.30
Total loan	3,466.35
Five per cent.	173.32
1-12	14.45
Demand loan	2,466.35
Five per cent.	123.32
1-12	10.30

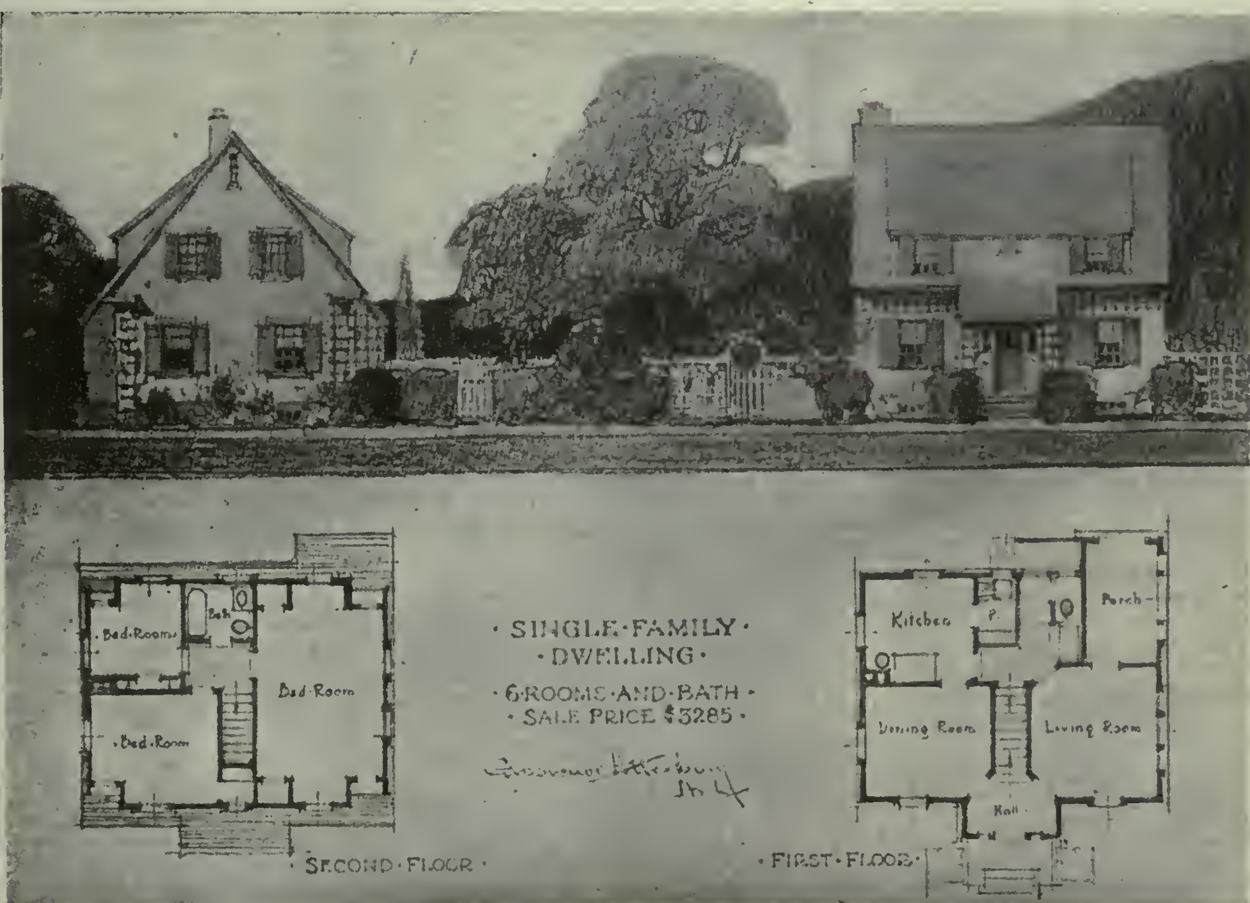
By following the table above, a prospective purchaser may start with the price of any available house and compute the amount of the monthly payment which he would be required to make.

The purchase price represents the actual cost of the house and land without profit to the company. The original purchase price of the entire area was divided by the number of feet in the tract to determine the base price per foot. To this was added a pro rata proportion of the cost of improvement such as sewers, highways, sidewalks, engineering expense and architect's fees.

In the case illustrated above, the cost of the land was $685 for a lot containing 6,850 square feet. To this figure was added the actual price of the house, without profit. This included the expense of the building, heating, lighting, plumbing, piping, hardware, fixtures, papering, window shades, screens, concrete cellar floor, granolithic walks, rough grading, finish grading, planting and clothes reel.

Individual Houses—Costs

Regarding the houses themselves, the plans and photographs reproduced herewith speak as clearly as any description. They could have been built more cheaply, but materials would be inferior; the costs could have been less in 1915, but



SINGLE FAMILY DWELLING, INDIAN HILL, GROSVENER ATTERBURY, ARCHITECT.

greater in 1925. In other words, the company has regarded the project as an investment for its own members, and in this aspect the long view of the transaction is the only justifiable one.

The costs of these houses individually shed an interesting illumination upon comparative prices of building as between 1915 and 1916. For instance, the constructional cost of the six-room house known as N2 has jumped from $3,188 in 1915 to $3,791 in 1916—an increase of nearly 19 per cent. The other types show similar results, though not quite so exact a comparison is possible, since certain changes were made by way of added features, the demand for the houses of ampler accommodations more than offsetting the burden of increased cost.

As to the general costs of a development such as Indian Hill, we find that the improvement of this acreage, that is, sewer, sidewalk and road building, tree planting and seeding, have amounted to just about 7 cents per square foot. This rate does not take account of overhead and administrative costs, which were not available. The amount chargeable to each of the fifty-eight houses built thus far, for town planning and architectural services, has come to about 2 per cent. This burden, horeover, light as it is even now, rests most heavily upon these first groups and will decrease still further with the progress of the development.

Any visitor to Indian Hill who would visit the interior of these cottages with a spirit of curiosity, or perhaps a touch of condescension as to their furnishings, is likely to receive a sharp mental jolt. The company, it is true, decorated and furnished a couple of houses to act as friendly counsellors to the others, but discounting this aid, it is only just to say that the average of taste displayed in these homes is remarkably high. There is very little overcrowding; the mass of gimcrackery is conspicuously lacking; there is discrimination, selective choice, and restraint everywhere. If one has sometimes been downcast by the bedevilment often worked by owners of mansions in their furnishings, let him turn to industrial cottages such as these and be encouraged.

FACTORY COSTS

By M. M.

British factory owners, it is frankly recognized, must begin in earnest to prepare themselves for the coming trade war if they would win in what promises to be a severe struggle, and many large houses are already considering the question of cheap power and fuel as one of the principal problems to be attacked. By the courtesy of the parties concerned, the Empire Resources Development Committee, which advocates the centralization and improvement under state assistance of power plant, offers the following interesting example of what may be done in fuel economy. It is that of a small glass works, the power for which is taken from a local power company at 1d. per Board of Trade unit. The glass furnaces are fired by producer gas of 130 B.T. units, the daily consumption be-

power charges work out at about $30,000 per annum, while the expenditure on coal by the producers is about $25,000. By means of a low temperature carbonization plant is proposed to do away with the burning of raw coal in the boilers of the power company and in the furnaces of the glass works. The gas produced from carbonization, although really a by-product, available for general use at a very low charge, has a B.T. unit value of 300 and is practically pure, so that 3,000,000 feet would do the same work for the glass company as the 6,000,000 feet now consumed, while the charge of 2d. per thousand feet (for the larger quantity) instead of 2½d., would show a saving of at least $50,000 per annum. Furthermore, the price charged to the power company would allow of a reduction of a ½d. per unit, thus showing a further saving to the glass works of $15,000 per annum. This statement of the case takes no account of the smokeless fuel, oil fuel, aniline dyes and other products, of which the country is in great need; but it is claimed by the Empire Resources Development Committee that, by suitable state action in relation to coal carbonization, a large revenue might be obtained towards the cost of the war without recourse to more disquieting expedients.

BRITISH MADE GLASS

By M. M.

At the last British Industries Fair held in London there was much evidence as to the marked advance shown in the manufacture of chemical and medical glass and porcelain. The exhibits included every description of laboratory glass, beside rod and tube, electric bulbs, engineering glassware, lenses and miners' lamp glasses. The specimens displayed, with two exceptions, included products from the fine modern factory of the Wood Bros. Glass Works Co., Ltd., Barnsley. Woods also exhibited surgical glass—another class of work to which glass makers have had to adapt themselves since the opening of hostilities, and lamp blown ware. Regarding the last named, a model glass house was organized and controlled as a department of the Sheffield University by Dr. W. E. S. Turner, which is now one of the centres in England for the training of pupils in the manufacture of scientific ware from glass tube by means of the blow-lamp, and similar efforts are being pushed in London and elsewhere, though in many cases they are carried out in the works of enterprising glass makers. It is not a new business in Great Britain, but it had been allowed to dwindle away until, in the days immediately preceding the war almost the only use made of lamp work in our glass factories was for repairing or touching up purposes.

ing about 6,000,000 feet and the cost 2½d. per thousand feet, exclusive of wear and tear charges, the coal used per day being about 50 tons. The total

In the summer of 1914 there was not a single manufacturer of laboratory glass in Great Britain. The whole process, the knowledge of which had been gradually built up by Germany during the past half century, had to be discovered and workers specially trained. At the fair no fewer than sixteen firms exhibited laboratory glass; six, glass rod and tube; twelve, surgical glass; three, laboratory porcelain; six, lamp-blown ware; three, lenses, and two miners' lamp glasses. And let it be remembered that every exhibitor had to be the bona fide maker of the goods shown. Two years ago British laboratory glass equalled, and often excelled, anything formerly obtained from Jena as far as the quality of the metal was concerned, and a year ago a great improvement was to be noted in the finish. The feature of this year is that the annealing difficulty seems to have been overcome, thus clearaway practically the last hindrance to the production in this country of chemical glass equal to the Jena article in every sense. In porcelain ware the same encouraging advance is to be noted. The whole wide range of the Royal Berlin productions has been gone through—Germany formerly satisfied our laboratory porcelain requirements to the extent of 90 per cent. from the Kaiser's own factory—the results being excellent in quality and finish.

The great point is that so far British prices compare very unfavorably with those of Germany, though this is in part, of course due to war conditions and will, in a measure, rectify itself. Laboratory glass is from 100 to 150 per cent. dearer, and porcelain about 50 per cent. dearer.

CANADIAN BOATS READY IN JANUARY

Hon. C. C. Ballantyne, Minister of Marine and Fisheries, has practically completed his work in London in connection with shipping and trade matters. His visit has bee of primary importance to the development of the Canadian shipbuilding industry. Next January, Mr. Ballantyne says, the first large Canadian government cargo steamers will be in commission, working in conjunction with the Canadia government railway system. The cargo boats will be fitted with cold storage facilities for the conveyance of meat, fish, and chilled rooms for fruit and dairy products. All boats will be under Canadian registry, and the rates will be controlled by the government.

While in London the Minister secured the release of a number of coal and ore-carrying vessels for the Canadian trade to keep the steel industries in operation. He expects the Canadian government will place a mill in operation next Spring. He also investigated the possibility of a development of the Canadian fish trade in Britain. Lack of cold storage facilities here is the greatest drawback to the frozen fish trade.

Haileybury, Ont.—Construction work by the Kipawa Fibre Co., at the site of its large new plant to the south of Lake Temiskaming is well under way. It is proposed to harness something like 4,000 of the 20,000 available horsepower for the time being.

Corrosion of Iron and Steel, and Its Prevention

Perhaps the Most Pathetic Feature of Man's Existence on This Planet is Illustrated by the Contrast Between the Immense Metallurgical and Manufacturing Industries Based on Iron Ore, and the Loss of Finished Metal Due to Corrosion

Being No. 7 in a Series by Abe Winters

ANOTHER fact which is well founded is that the presence of free iron has a marked effect in producing a precipitation of a vapor or suspended matter in a gas. It follows, therefore, that if a metal be heated in the presence of a vapor under such conditions that the gases or vapor contained within the metal are in part liberated; then, as the liberated gases or vapors contain some free ions, they will cause the precipitation within the pores of the metal and on the surface layer of a portion of the external vapor in which the metal is heated.

That all materials have a definite vapor tension is well known, this tension depending mainly on the nature of the material, the nature of the surrounding materials, the temperature and the pressure. It therefore follows that under all conditions all substances are surrounded by a certain amount of their own vapor. The vapor can be increased in amount by increasing the temperature and decreasing the pressure. Zinc vapor can be produced in several ways from zinc. If molten zinc is boiled in a reducing atmosphere, vapor is given off rapidly, and if heated iron is brought in contact with this vapor sherardizing would take place. This method is neither convenient nor economical because of the waste of zinc. The most practical and economical method is to use zinc dust, which is obtained as a by-product of a zinc smelter. This dust is practically amorphous, and each particle consists of a small inner particle of more or less pure zinc surrounded by a thin coating of zinc oxide. This oxide is very inert compared to metallic zinc and has a high melting point. It therefore is very advantageous in the process because it not only keeps the particles of zinc separated but allows the spheres of vapor surrounding them to act independently with a high vapor tension and permits the temperature to be raised beyond the melting point of zinc without its becoming molten. Therefore the percentage of inert material in the zinc dust plays an important part in the process.

Temperature and Time Important Factors

Temperature and time are factors which, depending upon each other, are very important in the process of sherardizing. They depend on the choice and quality of zinc dust used and also on the requirements and physical properties of the sherardized material. According to authorities on vapor tension, with an increase of temperature from 325 to 375 deg. C., the relative vapor tension increases 14 times and from 375 to 425 deg. C., the relative vapor tension increases 14 times and from 375 to 425 deg. C. the relative vapor tension increases 92 times. Zinc boils under ordinary pressure at 918 deg. C., and the boiling point under vacuum is reduced to 548 deg. C. Iron on being heated from 500 to 600 deg. C. in vacuum gives off gases readily. Therefore, it is quite clear that in vacuum the conditions are best for sherardizing. Since articles of different size, shape and character are treated, if each were given its ideal condition of temperature and quality of zinc dust, the time of treatment of all would be alike, but this is not practicable, for it is easier to vary the time of the process than the other factors. It is possible to obtain almost instantaneous sherardizing in the case of wire heated to a high temperature and allowed to pass through zinc dust at normal temperature. Not only the time of heating the article during process should be considered but also time of cooling, slow cooling is preferable for two reasons: First, to prevent loss from exposing hot zinc dust to the atmosphere (the metallic zinc particles would quickly oxidize): second, to prevent the articles being chilled too quickly. An article to be sherardized must be regarded first in respect to its ability to absorb zinc vapor, and then the condition under which zinc produces vapor at the highest tension. The most favorable condition under which the given article will absorb the most vapor must be obtained. In some cases it will be a selection of temperature or pressure; in some cases it will be the treatment of the article, as annealing, or the treatment of the surface mechanically (sand blasting or tumbling), or a chemical treatment such as pickling. A brighter metallic coating is obtained by using the manufactured zinc dust than with the blue dust, which is a by-product, the latter can be used with a lower metallic percentage and does not require as long time in processing and cooling and there is less danger of fusion of zinc due to slight overstepping the temperature limit.

When the article sherardized will be subjected to sharp bending or considerable variations of temperature, the thickness of coating will be limited, for zinc, being more brittle and having a different co-efficient of expansion than iron, will separate from the iron under these extreme conditions if too thick a coating is applied. Perhaps the greatest advantage of sherardizing, which makes it adapted where other processes are impracticable, is the fact that it gives a uniform coating over the entire surface, such as the inside and outside of hollow articles, on threads of pipes, bolts, nuts and on woven wire cloth. Because of its great adhering and alloying properties with the iron, the coating makes a very good basis or intermediate coating when plating upon iron with such metals as copper, tin or nickel, but combinations of this kind are not advised if most efficient protection from corrosion are desired.

According to Prof. C. F. Burgess, of Wisconsin University, if a sherardized surface is scratched by a file and exposed to the alternate action of air and water, rust will form in this scratch, filling it up and bridging it over and apparently bringing the action to a stop. This rust comes from the iron liberated from the electro-positive coating rather than from the underlying iron. Thus, a defect in a sherardized coating apparently tends to heal itself over while with other forms of covering the defect becomes exaggerated. Professor R. B. Leighon and Prof. H. A. Calderwood state that a sherardized coating should afford protection over a longer period of time and yield less readily to corrosion than an electro-galvanized surface, due to the fact that the former is less electro-positive to iron than the latter, their potentials being given as 0.296 volt for sherardizing and 0.472 volt for the electro-galvanizing. An abrasion test by these gentlemen, on a sherardized sample having three times the initial weight of zinc before the test showed twenty-two times as much after test as the electro-zinced sample, while another with about one and three-quarters times as much as the best electro-galvanized at the beginning had five times as much at the end, showing that sherardized surface is much more resistant to abrasion.

Commercial Requirements

In general, a protection against corrosion should conform to several conditions for commercial work. Prominent among these conditions are the following: The coating must be durable and of a reasonably permanent character. It must be conveniently produced at small initial cost and with low operating expense. It must be adapted to the particular requirements of selected products. There must be uniformity of results and conditions governing same. The coating must be controllable by predetermination of conditions affecting the production of the coating. The coating must have certain physical properties relating to strength or elasticity which are conclusive to resistance to wear or exposure to the elements, and the finished article must be of pleasing appearance.

The question may be asked why copper is being used so extensively on munitions for the British army. The answer is simply because the British specifications call for copper, and not because copper has been determined the most efficient protection for iron or steel military supplies. Iron and steel military supplies are being treated by immersion in phosphoric acid solution in the United States, but not because the U. S. Bureau of Standards has pronounced the process most effective. The bureau has recommended zinc in some forms. They do not specify any particular method of applying the zinc, but zinc alone is advised. Zinc on lead, copper or tin over iron or steel is not as reliable as a simple coating of zinc, a subsequent covering of lead has been found beneficial and such coating will withstand very severe salt spray tests. Bituminous paint over the zinc coating has also given very excellent satisfaction. Black nickel should be deposited over zinc to be effective as a protective coating. Nothing is gained by nickeling over zinc except a finish which will remain brilliant for longer period, the durability of the coating is not increased appreciably. The investigations now in progress by the United States Government will no doubt result in the production of a standard rustproof coating for iron or steel and when adopted by the industries the process should actually revolutionize metal finishing with reference to iron or steel products.

AEROPLANE MAKING GROWING INDUSTRY

In January of last year the Imperial Munitions Board, through Canadian Aeroplanes, Ltd., commenced the construction of aeroplanes for training purposes in Canada at the national factory, where the output of flying machines has now grown to a substantial total. The present capacity of the plant is 300 machines per month, which with the spares turned out is equivalent to 350 machines monthly.

The total number of machines manufactured to the end of last May, together with the spares, was 2,000.

The number of employees engaged at this factory is 2,150, and recently the plant has been engaged in constructing a number of bombing planes for the United States navy, showing how closely the two allied countries of North America are co-operating in their effort to beat the Hun.

New Type of Engine

The Imperial Munitions Board has placed a contract for the construction of an important number of the latest improved type of high power airplane engines to be used in equipping fighting planes for service at the front. This is a somewhat surprising development for a country so young as Canada in the airplane-making industry, as this particular design of engine represents the highest class of workmanship attained in any machine of this nature yet produced.

No engines are manufactured at the national plant, but are supplied from various outside sources and assembled and mounted there. The principal materials entering into the construction of the machines—apart from the engines—are spruce, fir and high grade linen, all of which are used in fabricating the wings. A large number of women are employed at the plant in this capacity. The bodies of the machines are composed of the wooden frame covered with canvas. The seating space is protected by an aluminum frame and the propellers are made of mahogany.

The board up to the end of May has contracted for the cutting of 248,000,000 feet of spruce logs, from which it is expected to secure 43,000,000 feet of sawed airplane lumber, in addition to 5,700,000 feet of rived spruce for the British Air Board, and required for the construction of airplanes.

Further contracts have been made with approximately seventy mills in British Columbia for their total output for extended periods of clear Douglas fir for use in the construction of airplanes.

In connection with the training of Canadians as airmen the Imperial Munitions Board has secured grounds, erected building and furnished equipment necessary for the carrying on of the work of the Royal Air Forces at its various flying centres, including Camp Borden, Armour Heights. Leaside, Camp Mohawk and Beamsville.

BITUMINOUS COAL TO BE OF GOOD QUALITY

More vigorous regulations than those heretofore issued to insure the production of clean bituminous coal have been made public by the United States Fuel Administration.

No bituminous coal will be permitted to be sold, shipped, or distributed if the same contains such quantity of rock, slate, bone, sulphur, fire clay, shale, or other impurities that it would not have been considered merchantable prior to January 1, 1916.

May Prohibit Shipments

Shipments from bituminous coal mines in which the coal is naturally of such character as to be unfit for market may be prohibited by the Fuel Administration. Operators also of bituminous mines whose products are capable of being made merchantable by complying with the requirements of the Fuel Administration in regard to the removal of impurities and who fail to comply with those requirements, will be required either to unload and clean such coal, if it has been loaded into cars or bins, or to deduct 50 cents per ton from the Government price. In the event of repeated violations on the part of such operators, such further action will be taken by the Fuel Administration as it may deem advisable.

The enforcement of these orders devolves, primarily, upon inspectors appointed by the district representatives.

These inspectors are required to familiarize themselves with the conditions under which coal is produced and prepared for market in the particular territory to which they are assigned, and to advise mine operators and employees of such methods as the inspectors may deem necessary to bring coal up to the standard, to inspect coal mining operations in their respective territories, and to make daily reports to their several district representatives.

Copies of these reports, with the recommendations of the district representatives thereon, will be forwarded to the Fuel Administration for final action.

Determined to Increase Efficiency

The order evidences the determination of the Fuel Administration to neglect no means by which it can assist in increasing the efficiency of every furnace in every factory and in every ship devoted to the prosecution of the war.

The enormous increase in the demand for bituminous coal incident to the entrance of the United States into the war, encouraged the opening of numerous so-called coal mines, a large percentage of the output of which resembled coal solely in color. This product brought the same price on the market as clean coal. The inevitable result was a general deterioration in the quality of all bituminous coal put on the market, and a consequent proportionate decrease in the heat generated in the furnaces of the country.

The new order is intended to correct that evil. It was prepared after an extensive conference between representatives of the United States Fuel Administration and the district representatives, who, besides being representatives of that organization, are practically coal operators, and were selected by the operators of the districts over which they have jurisdiction as their representatives. This order, therefore, is expected to effect the object for which it was passed.

The United States Fuel Administration also made public an order under which operators of bituminous coal mines may receive a special allowance for coal mechanically washed or extraordinarily cleaned or picked in such manner that the fuel value of the coal will be substantially increased by the removal of waste and impurities. No special allowance, however, will be made for the ordinary method of cleaning or picking coal.

This order supersedes all prior orders on this subject, and becomes effective at 7 a.m., June 1, 1918.

Amount of Allowance

The amount of the allowance contemplated by this order will be determined by the Fuel Administration, and will be set forth in a permit to be applied for and obtained by such operator in conformity with the provisions of the order.

Applications for such permits must be made to the license section, legal division, of the United States Fuel Administration, and must supply the information indicated in such applications, forms for which will be furnished on request.

Will Return Profits.—Henry Ford, through his private secretary, announced that he will return to the United States Government all the profits he personally makes on war contract work. He added that he expected a number of the other stockholders of the Ford Motor Company would follow his example.

Theory and Application of Sectional Views

Every Mechanic Should Know How to Make and Interpret Mechanical Drawings and Sketches of the Simple Type—Practical Course Prepared For Younger Men and Newcomers in Industry

Fifth of Series of Articles By TERRELL CROFT

Conventional Methods

REVOLVED sections are small views drawn within the outline of the object itself to show the construction of its members. In Fig. 16 the revolved sections M. N. and O, indicate that the portions of the object wherein these views are drawn are of circular, elliptical and channel sections respectively. These revolved sections are a great convenience to the draftsman, in that their use often enables him to specify in detail the construction of an object with only one main view and two or three revolved section views; whereas, without the revolved sections two or three complete views might be required. Sometimes, instead of showing the revolved section directly in the main view, the main view is broken to permit the insertion of the auxiliary section, as shown in Fig. 17.

Removed sections may be used where revolved sections cannot be employed effectively. Fig. 18 shows three removed sections which detail the construction of the rod. The removed sections are located outside of the outlines of the object. The plane at which each removed section is taken should be indicated by a section lines and letters, and the removed section itself should be lettered correspondingly. Thus, in Fig. 18 Section AA shows that a cut through plane A¹A¹ would disclose a hexagonal end view.

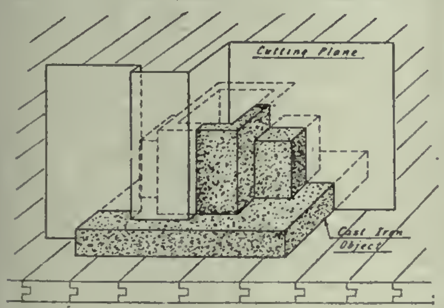


FIG. 15—NON-CONTINUOUS CUTTING PLANE.

A cutting plane does not, so it is assumed, cut through every member which it intersects. Thus there are certain objects which are practically never shown in section, though the cutting plane as indicated on the drawing passes through them. Some of these objects are: keys, bolts, screws, rods, shafts, studs, nuts, and spokes of wheels. A drawing giving an excellent example of this practice is that of the high-speed engine of Fig. 19, which is shown therein in longitudinal section. It will be noted that because of the fact that the piston rods, bolts, nuts, shafts and similar members are not shown in section, the drawing is much clearer and more expressive than it would be otherwise. This is in spite of the fact that a longitudinal cutting plane located symmetrically through the center line of the cylinder and the shaft would cut through the members above enumerated.

Assembly Section Drawing

Another good example demonstrating this principle is that of Fig. 20, which shows a uniflow engine cylinder in section. note that the piston rod, cylinder head, valves, bolts and nuts and certain other members are not sectioned. Fig. 21 gives a quarter section view of a roller bearing shaft plunger in which neither the shaft nor the bolts and nuts are shown in section, in spite of the fact that the cutting planes intersect them. The working drawing of a hand wheel is shown in Fig. 22. Note that in the sectional view to the right the upper spoke is not shown in section, although the cutting plane passes through its center. This Fig. 22 gives the accepted and correct method of rendering the sectional view of the pulley. The sectional view of Fig. 23, although it is theoretically correct for the pulley of Fig. 22 does not convey as definite an idea as to the construction of the casting as does the sectional view in Fig. 22. This explains why the method of Fig. 22 is used.

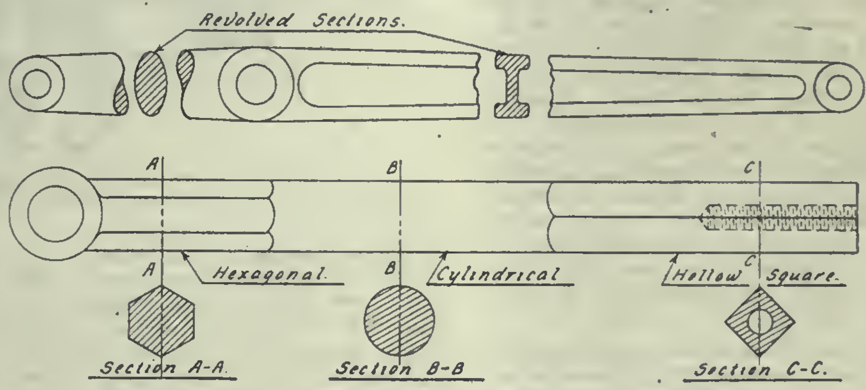


FIG. 16—ILLUSTRATING USE OF "REVOLVED SECTIONS."
FIG. 23—INCORRECT METHOD OF SECTIONING WHEEL SPOKE.

Webs are not shown sectioned even if the cutting plane passes through them. This principle is defined in Fig. 24F. Although the cutting plane AA passes through the center of the longitudinal web, the section AA shown at the bottom of the drawing indicates the correct method of rendering this web. That is, the web should be shown as if it were not cut through, because this method conveys a more accurate idea as to the actual construction of the object.

Section lining is usually at an angle of 45 degrees, although the lines may be drawn at some other angle if, to insure contrast, this is desirable. The drawing of the blanking-and-piercing die reproduced in Fig. 25 provides a good example of this maxim. Close examination of Fig. 25 will disclose that certain of the section lines representing steel are ruled at an angle of 45 degrees, while other steel parts adjacent to them are ruled at an angle of 30 degrees to insure the contrast just mentioned.

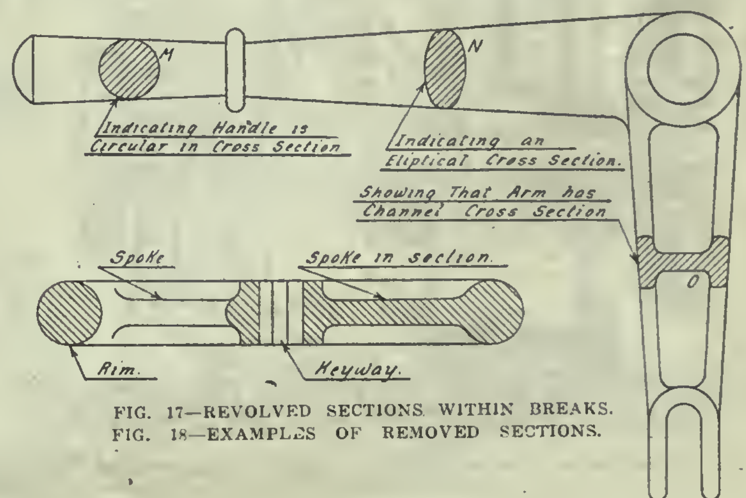


FIG. 17—REVOLVED SECTIONS WITHIN BREAKS.
FIG. 18—EXAMPLES OF REMOVED SECTIONS.

Drawing of Section Lines

The tendency of beginners is to draw section or cross-hatching lines too close together. Where the lines are too close together, not only is much unnecessary work involved, but the resulting appearance is not as satisfactory as when the lines are further apart. On working drawings, unless the area to be sectioned is very small the section lines should not be much closer together than 1-16 in. On sketches the section lines may be put in free hand. On tracings or ink drawings they should be ruled in, using a triangle as a guide. An experienced draftsman always spaces the lines with the eye. The numerous automatic section line spacing devices which are on the market are seldom used in commercial work. If the first few lines are spaced carefully the draftsman can with little effort, by referring to these as a guide, section the remainder of the area quite uniformly.

Often one sectional drawing may be made to detail completely the construction of an object. Consider the commutator core shown in Fig. 27. It is evident that the sectional drawing of Fig. 27 specifies completely the construction of this core. It is of course understood in a drawing of this character that certain of the dimensions represent diameters, and certain others lengths. Figs. 28 and 29 give two other good examples of sectional drawings which completely detail the construction of cylindrical objects.

Sectional views are of great usefulness in delineating power plant construction. If there were no such thing as a sectional view it would be almost impossible to show on a drawing the arrangement and construction of the equipment in a modern power plant. A typical transverse sectional drawing of a hydroelectric station is reproduced in Fig. 30. This discloses at a glance the principal constructional features of the station. Note that it is usual to take a section through one of the generating units. In Fig. 30 the section is taken through one of the water-wheel generators, and shows very clearly the construction and contour of the inlet and draught tubes for the turbine. A typical substation sectional view is given in Fig. 31. Here also the section is taken through one of the synchronous converters and shows its arrangement over the pit.

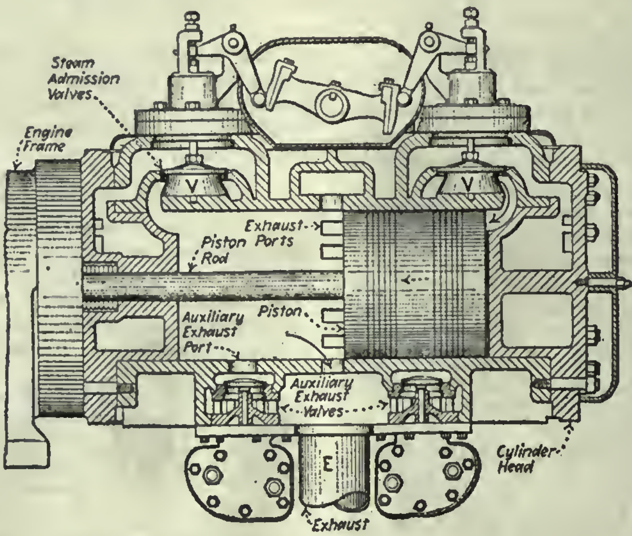


FIG. 20—SECTIONAL ELEVATION THROUGH CYLINDER OF UNIFLOW ENGINE.

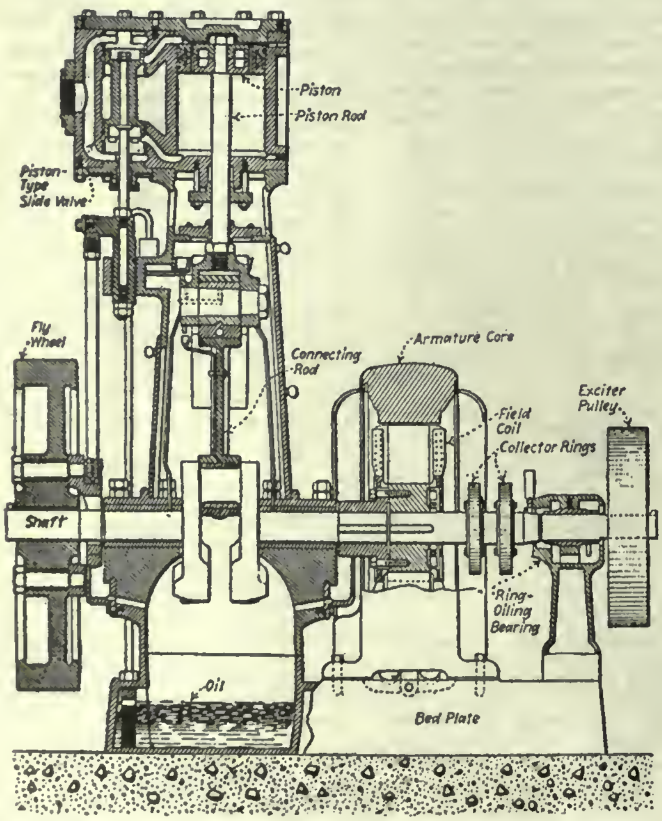


FIG. 19—SECTIONAL ELEVATION OF HIGH-SPEED DIRECT-CONNECTED GENERATING UNIT.

SMALL WORKSHOPS

By D. Street

The conviction of many people before the war that small factories would gradually be eliminated, that all industry would be carried on in factories of the largest size, and equipped in every way to ensure economy and rapidity of execution, has been disproved to some extent by the experience of the past three and a half years. The argument is sometimes used that small shops are a national asset, chiefly because they constitute an ideal training place for craftsmen, but small shops will not survive for this reason. Their value for training apprentices is undisputed, but modern industry has an economic basis. If the small shop meant a waste of labor and material they would have to go, indeed they would have gone long ago. Since the war started the small shops have proved proportionately as great an asset to the nation as the big concerns, and they have multiplied amazingly. All

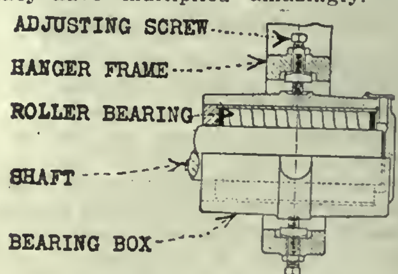


FIG. 21—DETAIL OF A ROLLER BEARING SHAF THANGER.

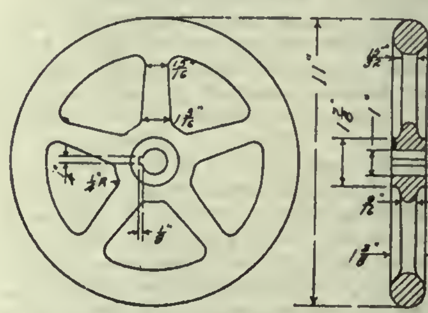


FIG. 22—WORKING DRAWING OF HAND WHEEL.

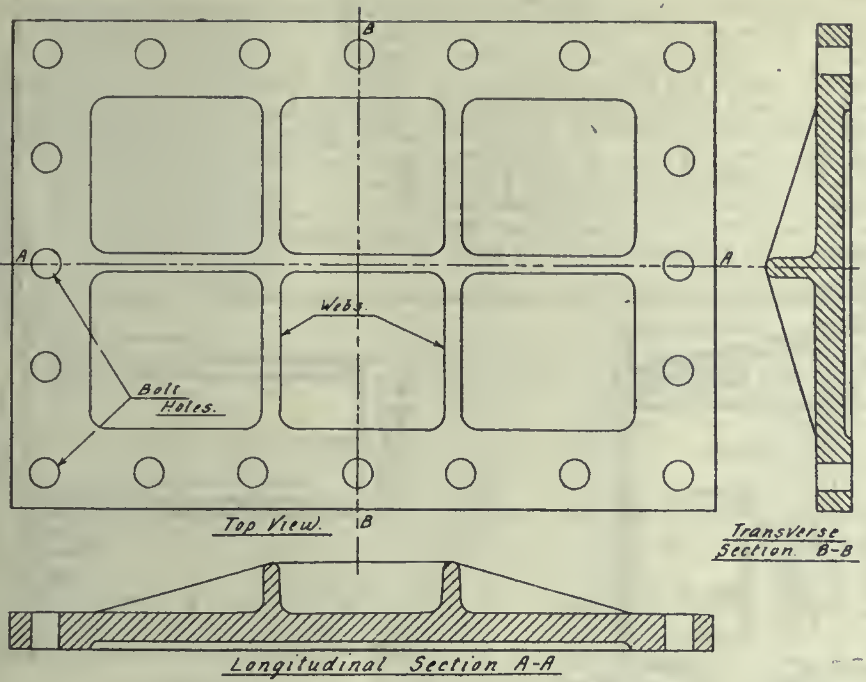


FIG. 20—GENERAL VIEW OF WORKING DRAWING.

over the country are small shell-making shops, and the work is turned out satisfactorily and quickly. The same may be said of the foundry trades. It is a fact that big engineering works that have well-equipped foundries and pattern shops often give some portion of their work to jobbing shops, and find that it costs them less than if the work was done in their own works, and this despite the apparent handicap of the small shop in the matter of machinery. There are many reasons why the extinction of the small shop would be regrettable, but there is fortunately every reason for believing that they will occupy an important place in the industrial system of the future.

Because the tendency of the time is towards standardization there is a fairly widespread belief that in a comparatively short time there will be no large general shops. The general shops, that is, the shops that will undertake any piece of engineering, and do not specialize in any way, have become fewer in recent years, but there will always be many of them. It ought to be remembered that very many of the large specialist firms have evolved from being general engineers. Indeed, the shrewd business man with sufficient initiative to run a small jobbing shop will gradually develop his business so as to cope with anything that may come along, and in course of time, because of the greater profits and the more regular flow of orders, he will specialize. To eliminate the small shop this type of man will have to be eliminated. There are men who are happier in supreme control of one or two men than as employees with a thousand subordinates.

The great usefulness of the small shop is in undertaking repair work. It may be true that if some part of a motor engine has to be repaired a duplicate part may be obtained by sending an item number to the maker, but it is not always convenient to wait for a few days. Again, when the part comes, some part of the engine has probably to be dissembled before the new part can be exchanged for the old. The standardizing of motor parts has not prevented the number of wayside garages from increasing. The same thing may be said for ship repair. Big vessels are, of course, overhauled in the big yards, but the smaller craft can be as cheaply repaired in the small place. Even more useful work than repairing is the work done for inventors. It would be interesting to know how many small concerns are kept going chiefly by inventive clients. The large firm is prepared to purchase a proved success, but it interferes with their organization, to experiment with an idea that may or may not be worth while. Of course, both for repair and experimental work there is practically no competition between large and small firms, and it may be admitted that it will become more and more impossible for men with small capital to compete in new construction with wealthy firms, who by subdivision of labor and automatic machines can cheapen production.

On the whole the management expenses of small firms are less than those of large firms, and there is the added advantage of unity and control. A great many large engineering works to-day are weighted down with foremen and managers. There is a false impression abroad that speeding up means multiplying the number of leaders. The small engineer is his own manager, and his interest is direct. He has cut out all waste, of which there is too much even now in engineering works, and a fair return satisfies him. This is especially true of hand work. There is every reason why a small foundry, pattern shop,

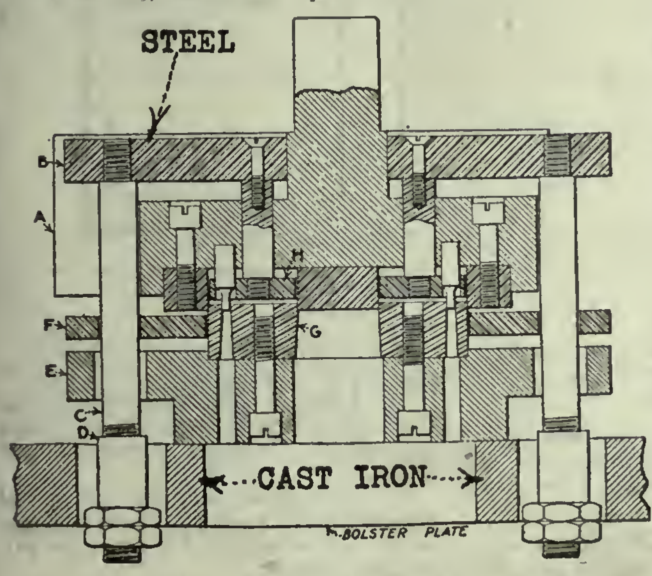


FIG. 25—SECTIONAL VIEW OF BLANKING AND PIERCING DIE.

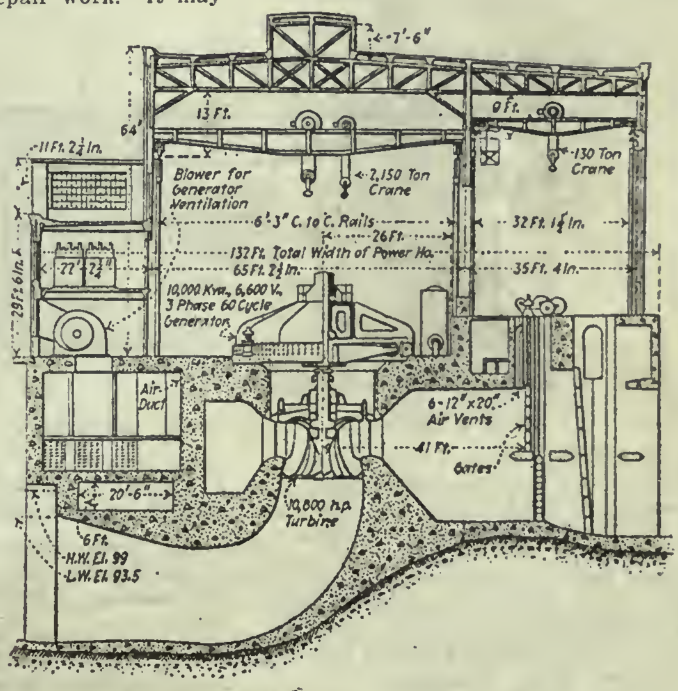
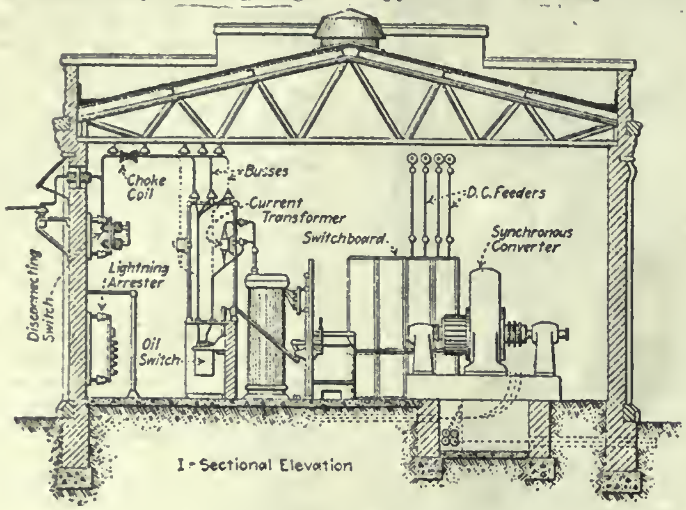


FIG. 30—SECTIONAL ELEVATION OF HYDRO-ELECTRIC STATION.

or fitting shop should turn out even cheaper work than a big shop, and it is acknowledged that the best controller of a big shop is the man who has served with a small firm.

It is quite probable that the development of industry in the future will take the form of large firms giving out a good deal of their work to small firms. It will probably be found cheaper to support separate concerns by ordering large quantities of parts from them although of course the work will be erected in their own works.



SUB-STATION.
FIG. 31—SECTIONAL ELEVATION OF SYNCHRONOUS CONVERTER

BIG SHIPBUILDING BUSINESS COMING

The National Shipbuilding Corporation has orders on its books for between $8,000,000 and $10,000,000 wooden ships for foreign account. These vessels will be built in Canada where the company has just secured control of the yard of the Three Rivers Shipbuilding Co.

Through the efforts of Newman Erb, chairman of the board, the National Co. at its American plant, located near New Orleans, will soon undertake the construction of small steel vessels running up to 3,500 tons deadweight. Next week it will launch the first of four steel tankers for the Mexican Petroleum Co., after which its activities will probably be confined chiefly to the wants of the United States Shipping Board and the Emergency Fleet Corporation.

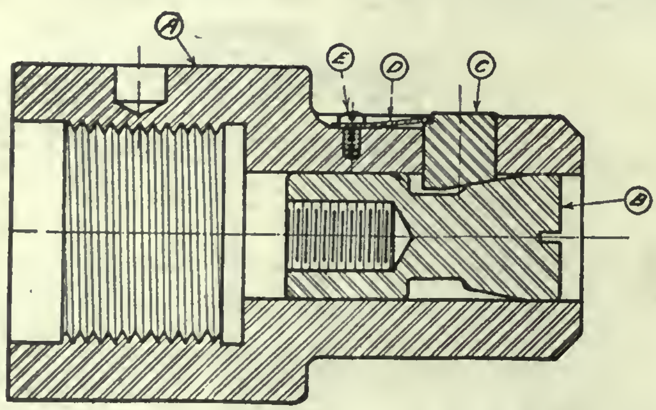


FIG. 28—DRAWING OF AN EXPANDING MANDREL.

In order that it might carry out its foreign contracts the National Co. has secured the capital stock of the Three Rivers Co., which has been building small wooden vessels for the British Government. The foreign orders in hand will keep the plant, having about fifteen ways, busy until the end of 1919.

The management of the National Co. has in mind the transformation of the shipyards into car shops should the shipbuilding industry show signs of lagging at the conclusion of the war. The company, in conjunction with its Louisiana plant, owns a canal, the operation of which may be taken over for the government by the Inland Waterways Commission, negotiations now being under way to this end.

TRADE INQUIRIES

The following trade inquiries have been received by the Department of Trade and Commerce, Ottawa.

593. **Tin caps for bottles.**—A large concern in Mexico would like to have quotations for supplies of tin caps or crown corks for bottles.

594. **Dry sulphite.**—A Mexican paper manufacturing company would like to get supplies of dry sulphite from Canada.

595. **Paper and pulp.**—A firm of Japanese importers would like to get supplies of paper and pulp. They would be glad to receive communications from Canadian manufacturers with regard to business either now or after the war.

596. **Asbestos fibre.**—A firm of Japanese importers would like to make arrangements for supplies of asbestos fibre after the war.

597. **Wire, wire nails, etc.**—A Japanese firm representing Japanese manufacturers wishes to correspond with Canadian manufacturers with a view to getting a supply of wire and wire nails either for present shipment or for business after the war.

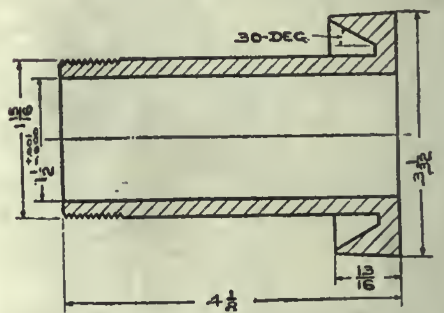


FIG. 27—COMMUTATOR SLEEVE DETAIL.

598. **Iron sheets.**—A Japanese firm of importers wish to communicate with Canadian manufacturers in reference to supplies of iron sheets after the war.

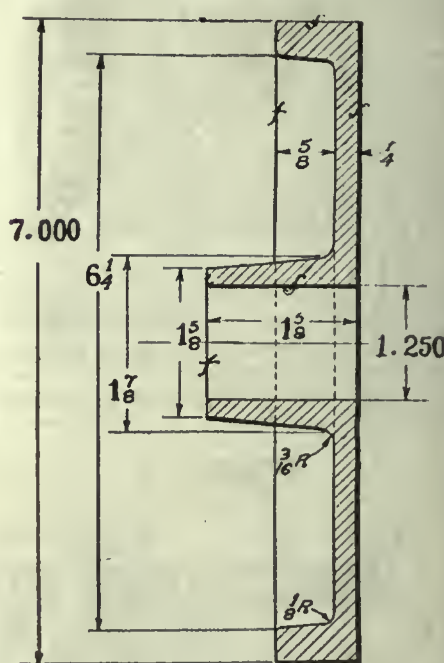


FIG 29—COMPLETE CONSTRUCTION SHOWN IN SECTION.

602. **Sulphate of ammonia.**—Large commission firm in Barbados is making inquiries for Canadian sulphate of ammonia.

603. **Galvanized buckets.** — Firm of manufacturers' agents in British Guiana would like an agency for Canadian galvanized buckets.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

RECORD SYSTEM FOR PATTERNS

By Wilfred G. Astle

The following system of keeping a record of patterns, also indexing and storing them, will eliminate any delay or errors made in selecting the proper patterns from the store-room, and has been successfully used in the shops of a large electric railway system in Indiana.

Requisition

The first form required is a requisition (Illustration No. 1) and is issued by the foremen of the different departments when patterns are required from the storeroom. This requisition is first approved by the master mechanic, and is then turned over to the pattern storekeeper, who supplies the pattern. If the pattern is a new one and has to be made up, the requisition is then turned over to the foreman of the pattern shop, and is his authority to make up the pattern. When the work is completed he forwards the pattern to the pattern storekeeper accompanied by a pattern report (illustration No. 2).

Office Record

The office record is shown Form No. 3 (see illustration) and contains details of the make-up of the pattern and the metal from which the casting should be made and the approximate weight of one casting. This form also shows the location of the pattern at all times. In order to make this record complete, it will be necessary to arrange the pattern shelves so that they can be divided by partitions and numbered. Each pattern is given an index number which will correspond to the correct name.

Tag for Outside Work

When it is necessary to send any pattern to an outside foundry for castings, a special tag is used (Illustration No. 4) which consists of three coupons, and is fastened to the pattern. When the pattern is ready for delivery the first coupon is detached by the pattern storekeeper, and forms a record of the pattern sent as well as the name of the party receiving it, the date of delivery, and the name of the department ordering it sent.

The second coupon is detached by the foundry receiving it, and requests that the foundry check the number of pieces according to the memorandum attached

REQUISITION FOR PATTERNS

MR........................ DATE............

MAKE THE FOLLOWING PATTERNS AND CHARGE ALL LABOR AND MATERIAL AS SHOWN BELOW.

MATERIAL	NAME	WHERE USED	DEPT.	CHARGE

PROBABLE NUMBER OF CASTINGS REQUIRED............

APPROVED .... ORDERED BY ....
MASTER MECHANIC FOREMAN

FORM No. 1—SHOWING REQUISITION FOR PATTERNS

MASTER MECHANICS DEPARTMENT.

PATTERN REPORT.

MR.....................M. M. DATE............

HAVE COMPLETED THE FOLLOWING PATTERN, INCLUDING CORE BOXES, GATES, ETC.

NAME............................. NO.............

WHERE USED...

ORDERED BY......................... DATE ORDERED...............

MEMORANDUM OF PATTERN PIECES.

GATED OR LOOSE PATTERNS			CORE BOXES.		
NO. GATED.	LOOSE PIECES.	MATERIAL MADE OF.	NO. PIECES.	MATERIAL.	CORES TO CASTING.

....
FOREMAN.

FORM No. 2—SHOWING PATTERN FOREMAN'S REPORT

PATTERN.......................SHELF..........................

NAME...

WHERE USED...

DEPARTMENT		METAL CAST OF		APPROX. WT. ONE CASTING	
GATED OR LOOSE PATTERNS			CORE BOXES		
NO. GATED	LOOSE PIECES	MATERIAL MADE OF	NO. PIECES	MATERIAL	CORES TO CASTING

REMARKS..

PATTERN HELD BY..

FORM No. 3—SHOWING OFFICE RECORD OF PATTERNS

PATTERN NO.............

NAME...

MATERIAL...

WHERE USED...

DATE SENT TO FOUNDRY...

GATED OR LOOSE PATTERNS			CORE BOXES				SHELF NO.
NO. GATED.	LOOSE PIECES.	MATERIAL.	NUMBER.	PCS.	MTRL.	CORES TO CASTING.	

REMARKS...

FORM No. 4—SHOWING MAIN PORTION OF SPECIAL COUPON TAG

PATTERN NO..........

FOUNDRY.........................

IMPORTANT.--THE FOUNDRY WILL PLEASE CHECK PIE CES RECEIVED WITH MEMORANDUM ON THE OTHER HALF OF THIS TAG, NOTE ANY SHORTAGE ON THIS HALF, RECEIPT FOR SAME IN SPACE BELOW AND RETURN WITH BEARER.

REMARKS............................

....

RECEIVED BY:

....

PATTERN NO.............

SHELF NO...............

FD'Y. SENT TO..........

DATE SENT...............

ORDERED BY.............

FORM No. 4—SHOWING COUPON PORTION OF SPECIAL TAG

on the third coupon, and that it receipt for the pattern on delivery.

The last coupon remains with the pattern and is a correct record of the type, number of parts and number of core boxes as well as the correct name and the material to be employed in the casting. The first coupon, which is detached by the pattern storekeeper, is kept in his office and the record that it contains is copied on the permanent office record.

FRICTION AND LUBRICATION

By D. Street

The experimental results obtained by such well-known authorities as Stribeck, Heimann, Beauchamp, Tower and others prove that the view commonly held, that the length of a bearing should increase in proportion to the speed, is wrong; and that some modern methods of automatic and forced lubrication are essentially faulty. In the case in which one solid substance is rubbed, on another without the intervention of any unguent, it is well known that however smooth a metallic surface may appear to the eye or touch, its real condition when looked at under a microscope resembles that of a very rugged mountain system; the peaks and chasms on the two surfaces crash into each other whenever there is any relative movement between them. The molecules are also assumed to be in a state of constant vibration.

No one would expect that any regular system of laws could be deduced from such a process, as a complete molecular theory of matter would be required to rationalize these phenomena; nevertheless, certain rough generalizations could, however, be made, which are useful to the engineer; namely, that the co-efficient of friction increases with the load, that it varies with the speed of rubbing, being greatest when the motion is slowest, until, at the point where one body is just commencing to move relatively to another, a maximum is reached. The friction at this point has been cleverly called "striction" and has been investigated by a well-known expert, Rennie, who succeeded in obtaining values as high as 0.3 to 0.4 for the co-efficient of striction for iron upon iron.

In the ordinary case of a greasy shaft lying in its bearings at rest, if it be assumed that the shaft be of smaller diameter than the brass bush, it would only touch it along a narrow line at its lowest point. As soon as rotation begins, the shaft no longer remains on the bottom of the bush, but rolls up the slope in a direction contrary to that of rotation and the point of contact changes according to the speed of the load. As the former increases, the oil will necessarily be carried round with the shaft until it forms a film separating it completely from the brass bush. The pressure is greatest immediately in front of the point of nearest approach between the shaft and the bush, and falls to nothing immediately that point is passed, maintaining a constant pressure through the remainder of the bearing. At still greater speeds it has been ascertained that the maximum oil pressure diminishes and that the shaft takes up a more central position in the bearing. If the speed were infinitely great, the shaft would run quite centrally in the bush and the positions of maximum fluid pressure would be vertically about and below the centre.

The important physical results of these observations are that they enable engineers to determine upon the best position in the circumference of the bearings at which the lubricant ought to be applied. With ordinary automatic lubrication by cup and syphon, or by ring, or centrifugal method of supply, the oil should obviously be made to flow on to the journal where pressure is least, that is to say, the oil should be fed from a point situated in the top rear quadrant of the bearing when the shaft is loaded by gravity only, and the point should be further back the slower the speed becomes. When the lubricant is supplied under pressure by mechanical means, it must be fed in at the points of greatest oil pressure, in the bearing. In engine bearings fitted with forced lubrication this has been found not to be usually done by the makers who did not threfore get the full advantage of the system.

The next point is a description of the nature and magnitude of the frictional resistance set up between the shaft and the bearing when there is an abundant supply of lubricant completely separating the two, thus preventing any metal to metal contact. In this case friction is due to the resistance of the oil to shearing or transverse distortion. With a film of oil of uniform thickness this friction depends only on the area of oil to be sheared, the viscosity of the oil, its temperature and the thickness of the film. Unfortunately there are very few cases in engineering practice where a shaft rotates at such a speed as would insure a uniform thickness of oil all round. In the case of turbines, motors and mill spindles this may happen, but in most cases the shaft moves to one side by an amount which depends on the speed and on the load.

With a film of uniform thickness the friction becomes less as the thickness of the film increases, and it would appear that in the case of a shaft rotating eccentrically in its bush, the increased thickness on one side must compensate for the thinning on the other side. This, however, is not the case, for it has been found from the Researches of Professor Osborne Reynolds, of Owen's College, and Mr. Sommerfield, another expert, that what is lost in friction due to thinning on one side is greater than what is gained by the thickening of the oil film on the other side. On the whole, therefore, the friction may be said to be increased by the eccentricity of the shaft in the bearing. Any increase of speed tends to reduce this eccentricity of the shaft and as a consequence to reduce the friction. On the other hand, as the speed increases, the oil resistance increases. There can be no doubt that the greater the pressure on the bearing, the greater the speed is at which the co-efficient of friction has a minimum value. The conclusions which may be drawn are that the ordinary assumption of a constant co-efficient of friction is incorrect and that, as a matter of experimental fact, it has been proved to be by no means constant but dependent on speed pressure and on temperature.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

ELECTRIC SEAM WELDER

THE Thomson Electric Welding Machine Co. of Lynn, Mass., have developed an electric welder for seamed goods of all kinds. It is particularly adapted to the welding of the longitudinal seam on pieces such as cans, stove parts flat pieces, and will also handle rectangular shapes such as metal boxes. Electric seam welding is faster than lock seaming or soldering and produces an airtight joint.

The piece to be welded is secured in a specially designed jig on the low horn or arbor; pressure on the foot treadle engages a clutch of the driving mechanism which causes the welding roller on the upper horn to move forward. This is actuated by the movement of a screw. When the welding roller comes in contact with the stock the current is automatically turned on. The current passes from the roller through the metal to be welded to the lower copper horn, thence to the transformer, thereby completing the electrical circuit. The resistance of the metal to be welded generates a welding heat so that the pressure caused by the roller makes a continuous weld the whole length of the seam. When the roller has reached the end of the seam the current is automatically turned off and the roller returns to its original position. The welded piece is then removed from the jig and the machine is ready to make another weld by repeating the operation.

Clean sheet iron or steel can be welded up to 16 gauge and up to 24 inches in length, and brass can be welded of lesser thickness depending on the character of the metal.

The machine is equipped with a 15 k.w. transformer which can be furnished for 220 or 440 volt, 60 cycle, single phase, a. c. circuit. Direct current cannot be used. One phase of a two- or three-phase circuit can equally well be used. The machine is equipped with a voltage regulator in order to obtain the different welding voltages for different kinds and thicknesses of stock. The automatic switch is adjustable for different lengths of seams. In order to overcome the electrical loss created by the increased distance of the welding roller from the transformer, and the effect of the inserted stock to be welded, the machine is equipped with an automatic variable reactance which consists of a coil wound on an open iron circuit. As the stroke of the welding roller increases in length the reactance of the coil is gradually reduced mechanically by lifting a closed copper cylinder over the coil. The movement of this cylinder is proportionate to the movement of the roller contact. The electric motor which operates the welding roller movement is of the variable speed type and can be furnished for either 110 or 220 volts, a. c. or d. c. power circuit. The welding roller bearing and the lower horn are water cooled.

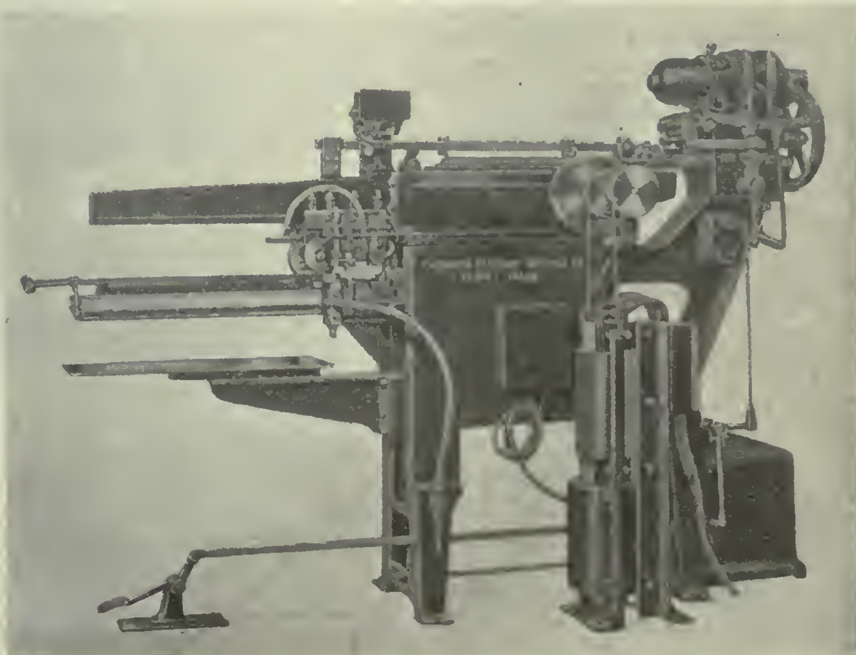
NEW MOTOR HEAD STOCK SPEED LATHE

The accompanying illustration shows a new four-speed alternating current motor headstock speed lathe, manufactured by the Oliver Machinery Co., Grand Rapids, Mich. This lathe is designed to operate on three phase two-twenty volt current.

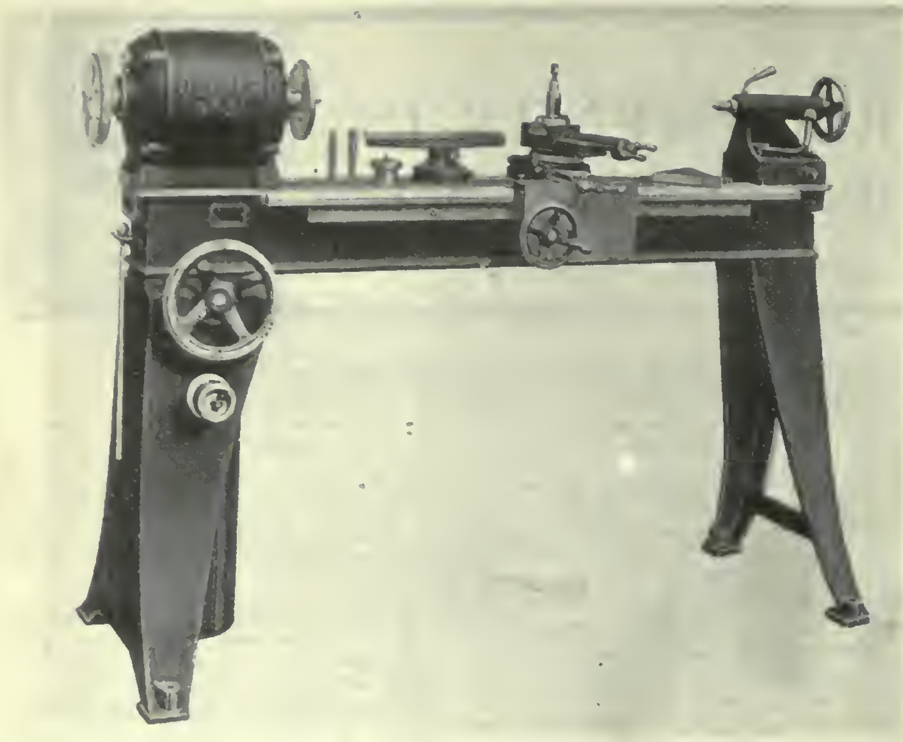
The lathe is shown with hand feeding carriage and compound swivel rest and may be furnished with plain bed in four or five foot lengths so as to turn twenty-four or thirty-six inches between centers respectively. The swing of this lathe is the same as that of the other motor head speed lathes manufactured by this company.

The motor headstock and ball bearings are totally enclosed in dustproof housings, thus being entirely dust and dirt proof. The rear end is fitted with a new feature, a combined hand wheel and faceplate. The edge is rounded off exactly like a handwheel and the inside face is curved in so as to give all the advantages of a handwheel while forming a perfect faceplate for rear end turning.

The controller of the motor has much the same shape as the standard street car controller but of course is much smaller in size and is mounted inside the left hand leg. This controller is operated by the hand wheel shown and this handwheel is marked with the various speeds possible, off, 570, 1,140, 1,725 and 3,450 revs. per min. Whenever any one of these marks is at the top the motor operates as indicated by the mark and the mechanism is arranged so as to prevent the operation of the controller in the wrong direction.



ELECTRIC WELDING MACHINE



MOTOR HEAD-STOCK SPEED LATHE.

ELECTRIC CENTRIFUGAL AUTOMATIC BOILER FEED PUMPS AND RECEIVERS

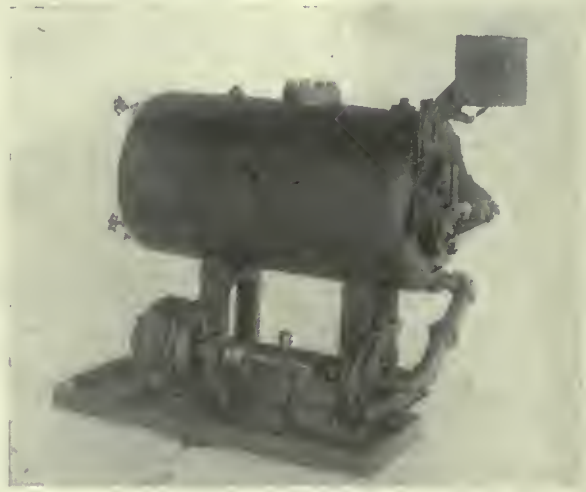
By F. C. P.

THE accompanying illustration shows a new electric centrifugal automatic boiler pump and receiver of particular use where it is not practical to operate a steam pump on account of low steam pressure carried, and where electric motor-driven centrifugal pump and receiver may be used to advantage. With this device the water of condensation flows by gravity into the receiver tank. As it accumulates, a copper ball float raises the control apparatus at end of tank which closes the circuit and automatically starts the motor. When the water is pumped out of the tank the float, of course, drops, thereby shutting off the current to the motor and stopping the pump.

As will be noted from the illustration, the pump and tank are mounted on a heavy cast iron drip pan, which catches the drips from the entire unit. The tank is made of close-grained cast iron, and is firmly mounted on two iron legs. The pump casing is of the overhanging type, and may be turned so that the discharge may be taken in any direction desired. The impeller is machined all over, and as the clearance between the heads and impeller is reduced to a minimum, the centrifugal pump is very efficient in operation. The pump and motor are connected by a flexible coupling and the bearing is babbitted and equipped with thrust collar.

The regulations relative to the use of starters or accelerating switches vary in different localities. Ordinary starters are not required on motors of 3-h.p. or less and compound wound motors are used for this service. When installing, the pump is placed as near to the boiler as possible and a globe valve as well as a check valve is placed in the discharge line to the boiler, the globe valve being placed between the check and the boiler.

This electric pump of the largest capacity for a radiation surface of 12,000 to 30,000 square feet delivers 60 gallons per minute, the maximum delivery pressure being 25 lbs. or 58 feet, the minimum speed being 1,905 revolutions and the maximum speed 3,600 revs. per minute. The 2½ h.p. motor weighs 1,200 lbs., and the receiver measures 20 inches in width and has a length of 41 inches. The motor is directly coupled to the pump.



BOILER FEED PUMP AND RECEIVER.

STRIKING HARD SPOTS SPOILS THE HOB

Not an Unusual Thing to Have a Tap Spoiled by a Slight Flaw

In threading the nose of the various types of shells the operation is generally performed in one of two ways, either by means of a collapsible tap or by using a solid hob. Many manufacturers are accomplishing this detail in the former manner, while others are holding to that of cutting the thread by the milling process.

Owing to the nature of the work it is necessary that considerable care be exercised to minimize the destruction of the taps or hobs utilized for this purpose. It is not alone in the actual threading of the nose that care should be taken but in the various details that are contingent to the heating and closing of the nose. Frequently during this operation, either through carelessness or neglect on the part of the furnace or press operators, conditions may arise that will result in the formation of local hard spots in the metal at the nose of the shell. In many instances these spots are unnoticeable until the thread is being cut and the hard spot will invariably have the effect of partially or wholly destroying the cutting qualities of the tap or hob. If a tap is used the possibility would be to wear away the forward or cutting teeth, the sizing of the thread being accomplished by the following teeth. The operation of a hob, however, is entirely different than that of the tap, inasmuch as every portion of the cutting length is responsible for producing the thread in the shell nose. The presence of a particularly hard spot very often results in the total destruction of the hob, as the speed of the latter does not permit of removing the same from the cut until the damage has been done. Just recently the writer was shown a British 14-thread hob that had been completely destroyed by one of these hard spotted shells. It appears that when the hob was being forced to its cutting depth the points of several teeth for a width of about one-half inch were broken off and imbedded in the metal of the shell, the obvious result being the destruction of the other teeth on the hob in the path of those first broken off. In the case of a tap the front teeth may be reground and serve until replaced with a new tap, but when a hob meets with such disaster the only remedy is to replace it immediately with a new hob.—J. H. R.

The Power Users Should Look Ahead Right Now

Ontario is Using and Calling For More Power Than is Available —The Steam Plant Should be Utilized For Power Where Steam is Necessary For Heating Purposes—Time to Take the Warning

By F. W. SUTHERLAND, Assoc. Editor Canadian Machinery.

RECENT reports concerning the available coal supply granted the Ontario district by the U.S. Fuel Administration point very strongly to the necessity for economy in coal consumption during the coming winter. It is extremely probable that only about 70 per cent. of last winter's supply will be available.

This will probably work greatly to the disadvantage of the manufacturer employed on the so-called non-essential industries and very little relief can be expected from Hydro-electric developments until the new year when the new penstock and turbines will be available at the Ontario Power Company's plant for the furnishing of about 50,000 additional horse-power.

The extent to which the consumption of electricity has increased may be judged from the demands made upon the Niagara system of the Hydro-Electric Power Commission. The Toronto system in November, 1917, had over 50.000 customers and a connected load of about 75,000 horsepower for which at that time only about 50 000 horsepower was available. The result of this power scarcity last winter was seen in the curtailment of street and storelighting and in the cutting off of feeders serving a purely residential load at times during the day when the peak load came on.

It it idle to expect any improvement in this condition during the coming winter, at least until new supplies of power are made available and in the distribution of the available power, munition plants, in the wider application of the term, must necessarily come first. Undoubtedly much power and light are absolutely wasted and the time is probably close at hand when drastic measures must be taken to curtail the use of electric energy now employed on luxuries and thus make it available for necessary purposes.

Niagara and the Munitions Industries

The diverse and extensive demands upon manufacturers for materials of war and of the necessity for ample supplies of power consequent upon this demand are sometimes overlooked. Of the immense amount of power generated in the Niagara district the greater part is used in manufacturing of munitions of war such as abrasives, aluminum, chemicals, steel and other electro-chemical and metallurgical products. The Niagara district supplies the bulk of the ferro-alloys, all-essential in the steel industry. Abrasives, cyanides, aluminum, carbon, electrodes, and many other products are urgently needed in the war game.

The average individual has little or no idea of the important part played by abrasives, to use the term in its widest sense. If asked concerning his knowledge of the subject, he would undoubtedly reply that it extended to the sharpening of the various cutting instruments with which he was familiar and that he possessed a vague idea that sometimes "grinding wheels were used in machine shops for various kinds of rough work.

So far is this from the truth that it need only be mentioned that modern grinding methods alone make possible the standardization and quantity production of munitions by means of the close limits in workmanship made available by their use. Not only are abrasives necessary in the making of munitions but their use is all essential in the manufacture of machine tools, textile machinery and other means whereby everything the soldier uses and wears is made. It is interesting to note that the artificial manufacture of corundum being carried on in the Niagara district has a direct and important bearing on the production of ferro-alloys, ferro-silicon being produced in quantities as a necessary part of the process.

1. One means whereby the power shortage may be somewhat minimized is by the use of steam power wherever available. This recommendation may seem somewhat futile in the face of the scarcity of coal but much can be done in the efficient utilization of the available supply. It is a notorious fact that central station energy can often be sold for a lower figure than that for which power can be generated in the isolated fact. This in a large measure is due solely to the inefficient operation of the smaller plant and when steam is used for heating or industrial processes it is not only cheaper to generate power from it and to use the exhaust steam, but it is a serious waste of the country's resources not to take advantage of this source of power. While the most efficient prime mover is only able to extract a small percentage of the total heat put into the working fluid, steam, when this power can be generated at a cost consisting of capital charges and maintainance only and the remaining heat utilized for industrial heating and other uses, the steam engine or turbine becomes a good investment and a direct aid to conservation.

Aside from the above means of deriving energy the more efficient operation of every steam plant or other means of using fuel for industrial uses or heating is a matter of some concern. The average power or industrial heating plant is after all no more economical than that notorious fuel consumer, the house furnace, and better operation ought to be rigorously enforced. It is an easy and not very costly thing to provide indicators, gas analysis apparatus and other means of testing fuel consumption and the benefits derived from their use more than balance the outlay involved. The elimination of soot and scale on boiler surfaces and proper methods of firing are also steps in the right direction.

2. The curtailment of power used for street and ornamental lighting has been of much benefit and the continuation of this means of saving energy may be expected for some time to come. It is probable that in addition further restrictions will be enforced tending to the limitation of power used in industries not essential to the winning of the war. This if put into effect would have a two-fold advantage in that it would also divert a certain amount of labor into very desirable channels.

3. The more efficient utilization of the capacity of existing plants in the Niagara district has been gone into rather carefully and much is being done along this line. Water is being used up to the limit fixed by international treaty and the excess capacity of the plants is thus being utilized. The new Chippawa project which the Hydro-Electric Commission has started will, with the more efficient utilization of the water, due to the greater head, provide about 200,000 horse-power, but this will not be available for about two to three years. The size of the individual units (50,000 horse-power) is larger than in any other hydraulic development in the world. While this plant is under construction the commission are moving as rapidly as possible to have additional equipment installed so as to have available in about ten months an additional 50,000 horse-power from the plant of the Ontario Power Company.

The situation as at present existing must necessarily work to the disadvantage of the places somewhat remote from the source at which power is generated and the recent action of the National Abrasives Company in moving to the Falls is explained when the engineering requirements in connection with the transmission of power are understood. Line and other transmission losses in this case amounting to possibly 10 per cent. are obviated and an equal amount of power saved for other essential industries.

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Sane Action On Housing Problem

IN another section of this issue is an article dealing with the housing problem as it has been dealt with by a large manufacturing firm in United States. Anything that will act as a fingerpost to the solution of this problem is readable now.

Strange that people haven't gone at the thing long ago and cleaned up on it. It has been tinkered with and booted around the premises until the name tastes sour, and smacks of some money-grabbing scheme that aims to get a set of hooks on to the pay envelope of the man in the shop.

But there is a better setting now. The whole business is being taken up by men who don't care a hoot whether they make a cent or not, as long as a large number of people have decent homes in which to live and bring up their families.

Rightly or wrongly there has been a fair-sized touch of suspicion attached to housing "schemes" in the past. The "schemes" suggested the "schemers," and there lay the trouble. The man who was tempted to go in had a quick vision of the bailiff and a forced sale of his few sticks of furniture when his payments were not made. He had heard of others who paid high rates of interest, and who made life miserable for themselves and their families by camping nightly in front of the calendar watching for the day of interest to come due, and wondering how under the sun he could scrape up enough by then to meet the payment. And when the payment was met, the free-for-all started again in anticipation of the next date.

As long as the principal thing in a housing scheme is the making of money for some schemer behind the scene, just that long will the thing be the miserable failure it deserves to be.

A goodly number of Canadian cities are coming to their senses in this regard. They are fast moving away from that form of insanity that found outlet in all the fool community "boosting" stunts that some overly paid publicity man could name in order to justify the existence of his office. And it's high time that there was a period of calm deliberate consideration of the things that will in reality boost any city or town.

If a city aims at commercial supremacy it has to have a good labor market. What makes a good labor market? Let the cities sit down quietly and think the matter over, and they will find several things, some of them being:—

(1) A well-housed lot of people, owning their own homes, or renting them at prices within their means.

(2) A tax-rate that does not make it desirable or imperative for a man to keep his home in the shack class.

(3) Some provision for the man who honestly desires a little wholesome advice and assistance in regard to acquiring a home for himself.

(4) The providing of the assistance in such a way that the man seeking it is not tying a millstone around his neck, and the giving of a fair chance to recover what he has put in the property in case he is not able to keep up payments.

It is not necessary, when housing schemes are considered, to open up a new tract of land. That plan often kills the scheme before it gets a chance to sprout and grow. The opening of new districts means putting a large amount of money into utility services, such as water lines, gas and sewer pipes, electric light services, the building of roads and sidewalks. Bulk buying of vacant property, in some cases at expropriation prices, is the solution in some places. It is sometimes necessary and even desirable to use pressure to make certain residents see that it is not desirable or possible that they should continue to allow thistles and burdocks to grow on vacant land in the hope that some other person's enterprise may make it worth more money.

Manufacturers are considering housing problems now as part of the investment they make in their plant. They have all been through the mill and they have all heard good mechanics say, "I can't stay in your plant because I can't get a decent place to live." And the manufacturer has known beyond the chance of an argument that the man was telling the truth, and known also that his organization would be the poorer because that class of mechanic had the big obstacle of no houses in the way of entering and staying in his employ.

It's a hopeful sort of a sign that housing is being seriously considered now apart from those interested in the securing of six and seven per cent. on a first mortgage. A mortgage should be turned into the best friend the mechanic can have, rather than transformed into a horrible club and suspended over his head. These things are possible, and we believe that it will be amply demonstrated in a short time that they are.

Letting Trade Routes Slide

SIR JOSEPH MACLAY, controller of shipping in Britain, has brought forward a fact that should not be passed lightly over. Speaking of the fact that Britain has provided the protection for U.S. forces crossing the Atlantic, he said:—

"But I might add, since the fact may not be well known, that we are only able to face these new responsibilities by sacrificing for the time not only British, but Imperial interests. Ships, which under normal circumstances are engaged in the trades between the British Isles and the Far East, Australasia, and India, have had to be withdrawn from service, and we have been compelled to sacrifice to a large extent communication between the Mother Country and the Dominions and the Southern Seas."

This statement was not made as a complaint; Sir Joseph was not urging that Britain was making too great sacrifices—rather it was simply a statement of absolute fact with which the people should be made acquainted.

Britain is letting her foreign trade slide; she is taking off boat after boat from trade routes that have been, and will be, matters of commercial life and death to her. The Island country is sparing nothing—Britain is in it to the neck, and will stay in it to the neck till it's all over and cleared up.

At the same time it is well to look forward to the day when trade routes will have to be won back, and when commerce and industry will have to ply again. War not only breaks down the enemy, but it weakens the people waging it.

COSTS NOTHING TO HELP THE OTHER CHAP.

Charles Thurston Ironed Out a Little Matter That Had His Friends "Stumped"

CHARLES THURSTON, answering his telephone one Sunday morning, recognized the voice as that of a man whose real name is not Bill. "Sure," he said "come right on over. If I can help you, Bill, I'll be glad to."

Half an hour later Bill arrived. To Thurston he mentioned his new job and, somewhat diffidently, broached the matter troubling him.

"I never had much schooling," he said. "And now, not knowing decimals, I'm kind of stumped."

"How's that?" Thurston asked.

"Well, it's this," Bill said, producing a micrometer; "I don't know how to use this, and I got to use it."

CHARLES THURSTON

"That's easy," Thurston told him. "But who put decimals into your head?"

Bill mentioned the name of a mechanical engineer to whom he had appealed for help some time before.

"And he shot clean over your head," Thurston said, understandingly. "Just you remember this, Bill," he went on. "This 'mic' is for making measurements to one-thousandth of an inch. Instead of the inch being split into halves, quarters, eighths, and so on, it is split into one thousand equal parts. Now if there are a thousand of these parts in one inch, there are exactly half as many in half an inch; exactly a quarter as many in a quarter inch."

Bill readily caught on, and after a little further explanation in words and figures understandable to him, he gratefully thanked Thurston for showing him how to use the micrometer.

CANADIAN MACHINERY relates the foregoing incident more for what it illustrates than for any virtue in itself.

In the case of Bill, it serves to show a need for a little further practical education that could easily and quickly be acquired. Moreover, it raises the question: How many machinists at some time or other find themselves, as Bill said, "stumped?" How many bump into the thing they don't know and never get beyond it simply because they dislike to ask a fellow workman how it's done? You can be pretty sure on one thing; they are men who do not read any technical paper and who do not know that good technical papers are pleased to give easily understood answers to men's work problems.

In the case of Charles Thurston, the incident serves to show the universal willingness to help others of men who have worked hard and studied hard to push themselves upward. Indeed, their further success very much depends on willingness and ability to instruct men in their charge.

Mr. Thurston started as a lathe hand in the machine shop of the Polson Iron Works, Toronto, twelve years ago. He was soon promoted to assistant foreman, and for the last five years he has been general foreman of the shop and in charge of installations of all ship machinery.

"I got ahead by doing my very best by the firm," he told CANADIAN MACHINERY. "Before coming here I was leading man in the Canada Foundry Company's plant for one year and seven months. Prior to that I was the Rathburn Company's leading man at Deseronto for six years. For three years I had charge of all the machinery in the Charles Thompson paper mills—known as the Napanee Mills—at Strathcona. I resided in Rochester, N.Y., for five years, working for the Shipman Engine Company; W. P. Davis, tool makers; and the Knolton Beach Company, paper box machinery manufacturers. About 1890 I returned to the little town of Glenora, near Belleville and again tried my hand at work to which I was apprenticed when a lad of fourteen. J. C. Wilson owned the shop, and we made small turbine water wheels. I was there eleven years altogether."

JUST imagine the reception one of those little German bands would get in this musical zone just now.

* * *

ONE way of describing an alternating current is by pointing to a fat man fussing at 95 in the shade about his coal bin being empty.

* * *

A MAN who sits in front of an electric fan and stews about the heat should take a 12-hour shift at a mill rolling plates or sheets. After that his 90 degrees' office would seem like a day late in the fall.

* * *

THE Liverpool *Journal of Commerce*, speaking of British methods, refers to "the stupid bungling and the 'village pump' official methods, which for the last three years have prevailed in the official policy of dealing with our shipping and shipbuilding." Such an outburst in this land would surely cause the censors to reach for the muzzle loaders and an extra big charge of rock salt.

We're Stayin' On The Job This Year

Steel production is keeping up remarkably well on war work despite the hot weather. —News item.

OH, rollin' steel's a job, my boy, for days what's cool and fine, and when the weather man ain't stokin' nor workin' overtime; when sweat ain't drippin' from your beak nor tricklin' in a stream, and runnin' down in pints and quarts and coasting on your bean.

On days what's hot it's easy work to let the whistle blow, and let them work and sweat what will, and let them come and go. It's easy then to shirk the job, to let things drift along, and make yourself believe such stuff ain't slacker type nor wrong.

But things is diff'rent now, me boy, we've somethin' more to do than go and look for shady spots and skies what's clear and blue.

In the good old days when loafin' off was quite the proper thing, we didn't have no Kaiser a-campin' in the ring, and tryin' to turn things up on edge and rule the universe, and get us all in shape to live beneath the German curse.

And we didn't have no Western front, no storm-rent bloody skies, no cry goin' up to us at home, "For God sake, send supplies!"

We didn't have no brothers then, no sons across the sea, a-facin' death and shot and shell instead of you and me—no boys from home in khaki clad had marched away to fight, no mothers' hearts were rent and sore, no long and sleepless night.

We didn't have no German planes a-droppin' bombs and things, until the air is pierced with groans, until it fairly rings with cries of children and of babes, with groans of crippled folk, who've had a glimpse of hell on earth beneath the German yoke.

So we're stickin' on the job, me boy, when days are hot as fire, and we're workin' for a greater thing than just our job and hire.

We're workin' for our sons, me boy, we're workin' for our home, we're workin' for them lads of ours in yonder shell-swept zone—we're workin' for them brave chaps there, our own folk and our kin, to keep this little world of ours from bowin' to Berlin.—Ark.

MARKET DEVELOPMENTS

Allies Don't Need Barb Wire for Defences Now

Interesting Side Light on War Situation—Firms Handling War Contracts Having Trouble in Securing Deliveries—Progress Has Been Made in Settling Prices of Some Staples

THERE seems to be small chance for Canadian business talking of expansion, if such expansion depends in the first place upon their chances of going into the steel markets for increased supplies. The fact is that there is no chance of increased steel supplies coming to Canada. Taking that as the starting point, the only thing is to make the available supplies go to the points where the most essential work is being carried on from the viewpoint of the war officials. It has been a hard matter for the Canadian allotment of steel to be sustained week by week. In fact there have been times when there has been a falling off.

Conferences have been held between jobbers and the War Trade Board and in many staple lines prices are now recognized as standard, but there are a few lines that are not settled, the authorities holding that the warehousemen were doing business at too high a figure. The latter base their contention, in part at least, on the fact that their export trade is largely gone for the present, and that with this revenue cut off their overhead charges have not decreased at all.

The big problem for dealers in machine tools just now is not the securing of new business, but the filling of orders they already have on their books, and partial delivery of which has been made in a good many cases.

The situation in this regard is not all that could be desired by any means. This is not common to this country, but practically all over United States the same story is heard. There are going to be some delays in deliveries on new shell contracts. Contractors do not favor the plan of going ahead and working on one or two operations in a shell plant, waiting for the rest of the work to be done when the machines arrive. The shop gets clogged at this one stage. The only way is to get a steady flow through the shop on all operations, and the non-delivery of certain machines is delaying this.

An interesting little sidelight is brought to notice in a despatch from one of the big steel centres of United States. It announces that the call for barb-wire for defensive purposes is falling off tremendously among the Allied forces since Marshal Foch took the offensive on the West. Mills that were working on this are getting instructions to turn more to other war lines.

NOT MUCH BARB WIRE NEEDED SINCE FOCH TOOK THE OFFENSIVE

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., Aug. 28.—Testimony given last week by departmental representatives to Congressional committees considering "manpower" or draft legislation, that the war can be completely won before the end of next year by America's whole force being put into the work, furnished the steel industry no new view of the situation. For some time past the preponderating view in the steel trade has been that the war would be won before the end of next year. This view obtained despite the fact that the steel trade well knew that the war machine is preparing for five years of war. Whether in holding this view the steel men were depending upon their judgment, based upon the vast weight of steel that is being thrown, and is to be thrown, into the war, or merely reflected the assurance given them by the military authorities, with whom they are in constant and close contact, is not known.

Secrecy in the Work

There is nothing that could pass muster as representing even a partial inventory of the applications of steel in the war, but the fact should always be borne in mind that this absence of detailed information is due solely to the secrecy imposed. The information exists, but only on the hands of those whose duty it is to know. It is never allowed to pass farther along the line than is necessary. One man, for instance, a prominent steel company official, distributes all the orders for shell steel. He knows to a ton how much has been furnished and how much is on order, and he knows approximately how much additional is to be called for in the near future. The mills with which he places orders, however, do not have the total figures either exactly or approximately. A committee of three distributes the sheet orders, though the chairman is chiefly responsible, and thus it is all along the line. These are men in the steel trade. They do not know, except approximately, what is coming in the way of requirements. In some commodities they are better informed than is the case in others, because some commodities are required regularly for continuous work, as in shell making, while in other commodities, as in structural shapes, the needs vary according to the different projects taken up. The War Industries Board, on the other hand, has much advance information of requirements.

Requirements Increasing

What is to be observed at the present moment is that the steel requirements for the war are increasing, as to the total. Few military purposes for which steel is required have been entirely fulfilled. Even the cantonments, for the preliminary training of men, while completed long ago according to the original plans, are now in some cases being enlarged. Shipbuilding grows constantly, of course. Many of the shipways are not completed yet. The furnishing of equipment for ships must increase greatly, as many ships recently launched are awaiting equipment. This includes engines, boilers and a thousand and one minor items. Shell manufacturing is increasing. Railroad operations in France contemplate a larger and larger scale. In addition to many small cars ordered in the past two or three months for the A. E. F. orders for 20,000 additional cars have just been approved and the distribution is now being made, while rumor has it that 30,000 or 40,000 more cars may be ordered in the near future as part of this program. For the rebuilding and enlarging of the two railroads across France allotted to the A. E. F. 150,000 tons of rails were ordered about a year ago. Other and smaller orders followed, and in the past few weeks 200,000 tons additional have been placed. Conferences as to price did not reach a conclusion and the orders are being filled subject to a price to be determined later. Including the light rails required for the narrow gauge trench railways the orders for the A. E. F. to date doubtless total more than 500,000 gross tons, this being entirely apart from rails furnished the French authorities

This is Splendid

Through the change in the character of the military operations the demands for barb wire have been lighter in recent months, and Marshall Foch's principle of keeping always on the go seems to preclude any large demand. It may be remarked parenthetically, however, that so precisely does the machinery for employing the steel industry for war purposes work that this does not make wire more plentiful for civilian use, since immediately there is provided an offset. Orders for a large tonnage of 82 mm. rounds for France have just been distributed, and a large part of the business has been given to wire plants, whereby such plants will change rolls on their small billet mills, to roll the rounds, and the small billets will no longer be available for the rod mills, so that wire production, lately no more than 60 per cent. of capacity, will be reduced further. The demands for pipe for war purposes are very heavy, much greater than was expected. Last year, when a very large order for large pipe for the British operations in Mesopotamia was completed, it was thought that not much more such pipe would be required, but large pipe is now being used by the A. E. F. on an important scale, while there is heavy demand for shipbuilding and for the equipping of various new war plants.

In Total Figures

Thus while available information is quite fragmentary and very far removed from being complete, it affords entirely satisfactory grounds for viewing with profound respect the current estimates of the War Industries Board that 20,000,000 to 22,000,000 net tons of finished rolled steel is required for the present half year, and not less than 20,000,000 tons for the first half of next year. The estimates, of course, include some allowances, perhaps rather meager, for the commercial industries at home that must be maintained to keep up the country's war efficiency.

POINTS IN WEEK'S MARKETING NOTES

Production at United States mills has been showing a marked improvement in the last few days.

—

Shipments to jobbers of finished steel are much lighter than for some time past, and it looks as though they would be cut down still more.

—

Information from big steel centres of United States says the belief is firmly held that the war will be won by the Allies before the end of 1919. Whether this is so or not, all business there touched by the war is being planned on five years of war.

—

The demand for barb wire for defensive purposes has fallen off in United States mills since Foch took and maintained the offensive.

—

Wire manufacturers in United States have been ordered by the government to turn over to the making of shell bars, large orders of which are for shipment to France.

—

Canadian customers having occasion to enter the steel market at present are finding that they have little chance unless their claims are particularly urgent.

—

New lists out on wrought iron pipes place the prices quoted at a higher figure.

Production

Production has been somewhat heavier in the past ten days, through a partial recovery from the backset given by the extremely hot weather of the first fortnight in August, but the month as a whole will probably show smaller production than July. September, however, will probably see the restoration of the June rate or even a higher rate. There is more dissatisfaction with blast furnace performance. as the output is out of line with the large number of furnaces in blast. Questions of coke supply, coke quality and labor performance are being studied still more carefully. While new construction has been considered, it is held full performance of existing manufacturing facilities must first be attained. It may still be estimated that the output of finished rolled steel in the present half year should be fully 18,000,000 net tons.

Distribution to Jobbers

Jobbers are receiving even lighter shipments of finished steel than was expected as a result of the July orders relating to jobbers, which provide a B-4 priority rating, first for August shipments to an amount equal to one-sixth the tonnage received during the first half of the year, and then for subsequent months an amount equal to the tonnage distributed by jobbers the preceding month against priorities and the preference list. The jobbers have received scarcely any merchant steel bars or sheets, and their receipts of standard steel pipe and of wire products have been less than expected. This exemplifies the shortage of steel, since B-4 is a high degree of precedence. It yields to most of the priorities, but comes before the entire preference list.

BIG CALL NOW FOR SHELL STEEL BARS

U. S. Government Order Wire Drawers to Turn Capacity Now on This Material

Special to CANADIAN MACHINERY.

NEW YORK, August 29th.—Wire manufacturers have been called upon by the Government to produce shell steel bars in large tonnages. It will be recalled that a few months ago the wire drawers were instructed to cut their output 40 per cent. so that the crude steel they were making could be sent to other plants for the manufacture of ordnance and projectiles. The rail mills were largely utilized to roll shell steel bars.

Now, the pressing demand from domestic railroads makes it imperative that some of the rail mills, at least, be released to roll standard section rails. In this emergency the wire manufacturers were selected by the Government to render assistance so that there should be no decrease in the supply of shell steel to be sent abroad. For several weeks the Donora plant of the American Steel & Wire Co. has been adapting its machinery to roll shell bars and in the past ten days it has installed tables for this purpose. The first order given to the Donora mill is for 20,000 82 mm. rounds for shells to be exported to France; shipments begin this month.

Want More Shell Brass

Other wire manufacturers also have received similar orders from the Government so that 50,000 tons of rounds will be shipped to France this month. It is understood that orders for at least 100,000 tons of shell bars a month will be rolled by wire manufacturers. This is about one-fifth of the monthly tonnage required by the Government for domestic projectile makers and for export to the Allies.

The American Steel & Wire Co. has capacity to produce 200,000 tons of wire products a month but because of the shortage of wire steel its output was cut down to about 120,000 tons two months ago. If the 20.000 tons of shells which it must now roll for the Government are deducted from the tonnage available for conversion into wire products, its regular customers will be compelled to further curtail operations as only 100.000 tons a month will be available; that is, the largest wire drawers are now operating on 50 per cent. capacity. Large independent wire makers have also been obliged to cut down production. The Pittsburgh Steel & Wire Co. is now operating 50 per cent. capacity and the Jones & Laughlin Steel Co.

only 40 per cent. of their wire capacity.

To Be Sent to France

Orders for 21,000 tons of plain wire and for 2,600 tons of wire rods are now being distributed by the sub-committee of the Iron & Steel Institute for export to France in September-October-November. Allocations of 100,000 kegs of eight and tenpenny wire nails are also being made for army camps at home and for additional construction in France.

The War Industries Board has determined after conference with the Steel Committee of the Iron and Steel Institute to give preference of steel shipments, temporarily, to the railroads and to manufacturers of railroad equipment. Motive power, cars, rails, and other equipment must be furnished domestic railroads speedily to prevent a recurrence of the severe freight congestion that unsettled industry last winter. Railroad equipment is also urgently needed by the American expeditionary force in France and there are pressing demands from Italy and Japan.

Railroads in the Central West have finally succeeded in placing contracts for a large number of machine tools. The Monon at last has distributed orders on their list put out last May. The Rock-Island, Illinois Central and the St. Paul have ordered a number of lathes and boring mills and the Santa Fe is about to close on the list put out ten days ago.

The Foreign Trade

The Japanese Government is enquiring in the Cincinnati market for 100 24-inch lathes for prompt shipment and Japanese exporters are inquiring for a large number of portable electric drilling machines. The Tata Iron & Steel Co., Sakchi, India, has purchased eight magnets from the Electric Controlling & Manufacturing Co. The Tacony Ordnance Corporation is buying large boring and turning lathes for the manufacture of guns. There is great need of marine engines, boilers and other equipment and the Emergency Fleet Corporation is now concentrating efforts to secure such machinery.

WANTS TO HANDLE CANADIAN OR AMERICAN BUSINESS IN FRANCE

CANADIAN MACHINERY is in receipt of the following letter from M. Lacombe and A. Blachere, of Lyons, France. This company is open to do business with Canadian or American firms.

The letter translated follows:

Lyon, July 22, 1918.

We have been receiving your journal for some time and are greatly interested in it. Could we enter into business relations with some of the firms who advertise in it?

The firms which are of especial interest to us are those making screws (bits, augurs), raising or hoisting tackle and gear, conveying machinery, industrial oils and greases, ball bearings, automobile accessories, lifting jacks, etc.

We should like to become acquainted with a firm who on satisfying themselves with the references we would supply would treat us as their depository agents in France.

Correspondence would have to be in French. Such a firm might be either Canadian or U.S.

NEED GOOD REASON FOR BUYING STEEL

Canadian Trade Finding the War Pressure Becoming Harder All the Time

TORONTO. — Canadian customers have to show remarkably good reasons for going into the steel market now. This has been the case more or less for the past six or eight months, but the coming of each week brings a more pronounced change in the situation, and all the changes move in the same groove. As a matter of fact industries in Canada that have occasion to buy steel are up against more or less of a stone wall. There is a certain tonnage allotted to this country each week, or month, by the War Industries Board at Washington, and that is all that can be secured. This of course refers to imports, and not to steel produced in Canada, but it is on imports that we are largely dependent. So it is a case of making the material available go around rather than striving to get concerns to use more.

The licenses and priority orders that the mills require automatically expire if the obligations have not been met by the mills on the date mentioned in the papers. There is considerable confusion at times in connection with getting renewal privileges for these.

The demand for war machinery is quieter this week. In fact the big thing in the hands of the machine tool-dealers is the securing of the machines to fill contracts that have been on their books for some time.

Scrap Prices Firm

No changes are noticed in the scrap values this week. It might be imagined that there would be a lot of scrap in the way of turnings from shell plants because the volume of material going through these plants is very large at this moment. However, it does not reach the scrap metal trade, its disposition being arranged beforehand by the War Board authorities. Information received from outside points shows that there is a decided shortage in many foundry yards, and there is nothing in sight in the trade that is going to relieve it.

American points state that there is difficulty in securing transportation even when a lot of scrap is found, the carriers claiming that they are overloaded now with business that they consider to be more pressing.

Settled Price Matters

Through conferences with dealers the matter of prices has been settled in some of the principal lines. The biggest article in volume now is plate for ship work, and the Government recognize 10c per pound for this. Dealers are quite frank in advising the trade that it is useless to send in orders unless they are absolutely certain the work is of the most vital importance, and urgent enough to cause the War Board to put a very high rating on it.

As a matter of fact in the last eight weeks instead of getting 8,000 tons of plate this country has received about 5,000 tons, and working from this, it is easy to see that there is absolutely no chance at all for the man who wants steel, especially in the shape of plate, for anything but the most urgent purpose. There was a supposition some months ago that three months of concentration on war work would pile up such a heap of material that the commercial interests would be well treated at the expiration of that period. Whenever it looks at all hopeful for this coming true the war appetite doubles up, and the commercial chances go in a heap, and they are right now in a heap with poor chances of getting straightened out.

The prices on boiler tubes, it is understood, are somewhat of an open question, the War Board holding for a lower figure than asked at the moment by the warehouses.

The Matter of Ratings

The mills are in better shape than the customers in the matter of priorities. In case a mill accepts an order to deliver on a certain date their obligation for the work ceases when that date arrives and the order has not been rolled. On the other hand it is up to the dealer to apply to Washington to have his priority and license renewed to protect his business. There has been some confusion in regard to the working of this regulation.

A new list has been issued for iron pipe, an increase being noted in nearly every size. Dealers claim a shortage of skelp is responsible for the situation.

A Matter of Delivery

There is one inquiry this week regarding equipment for a shell plant but the contract in this case has not been secured yet, and the chances are that the contractor is hesitating over making promises regarding the delivery of shells. As a matter of fact there are a number of shops all over the country that are considerably embarrassed at the non-arrival of machine tools. Jobbers are having some interesting sessions explaining to the trade why deliveries are not made. This condition is not peculiar to this country, as reports from United States points indicate that much the same thing is holding up deliveries of finished shells there. Contractors hesitate to go ahead with first operations to any great extent, preferring to wait until their whole plant is in shape to get a steady and continuous flow of work through all the operations in proper sequence.

Machinery from United States points is having a hard time getting to its destination. One firm has an order six weeks on the road from Cincinnati. In this instance a customer from a point in Saskatchewan came to Toronto believing that the shipment would be here some time ahead of him. On his arrival he found that the goods he came to inspect for purchase were still on the road.

A traveller for a large American firm stated to CANADIAN MACHINERY this morning that buying of high speed steel had been carried on on an unprecedented scale during the last few weeks. Getting supplies for the Canadian buyer had been harder on this account. The American buyers had orders in very large quantities, and there had been a busy time in spots trying to keep pace with the call for hobs and reamers. In some of the work there it had been found in machining operations that the work of the forges had been rather indifferent. When the shells were put through some of the heat treating processes they had apparently been hardened to such an extent that some of the shops could hardly secure a tool point that would make a mark on them. Mechanics, this traveller stated, who had gone to United States from Canadian plants claimed that the forging that had been done to the specifications of the Imperial Munitions Board in Canada was much more uniform, and much easier to work in the machine shops. The result apparently has been that indifferent production results have been secured at some of the U. S. shops.

STOVE MANUFACTURERS HAVE BEEN GIVEN NO STANDING BY GOVERNMENT

IF one were to judge from reports of actual sales that are being made by the sales departments of iron at United States points it would appear that very little business was being done in any of the foundries. Of course quite the reverse is the case. The Government is practically handling the output of all the furnaces and the selling by them independent of Government control is being discouraged. Some of the industries of the United States that have not yet been listed are making big efforts to secure consideration at the hands of the Government but have so far met with rather indifferent success. The reports concerning the big iron situation from United States points are as follows:

Cleveland—A fair amount of selling for next year's deliveries is being done but it is all subject to Government restrictions. The new forms that are being sent out by the producers are now being distributed and it is found that they require considerable more data than has been given in the past.

Boston—The survey of the situation here would lead to the belief that there are a number of concerns all over this district who may not be able to do business in a few months because of the scarcity of iron. The stove business in particular is in danger of being considerably curtailed in this way. The latest reports state that some arrangement may be made whereby a certain number of stove concerns may be allowed to turn out material for the trade in limited quantities. No hope is held out whatever for unrestricted production.

New York—Dealers who in the past have been in the market years selling foundry iron are practically out of the way at the present time. Although many of these desire to take care of their own trade it is not possible for them to do so because Government places orders and these allocations have to be considered first. They simply keep on piling up and destroy any chance whatever of private business being considered.

Buffalo—The producers here are most swamped with orders from consumers all over the country for any grade of iron, but in almost every case the answer is the same, that the producer will do business only on allotments made by the Government.

Chicago—Contracting for pig iron for delivery during the first half of next year is in a very limited scope here at present. Only the requirements of regular customers engaged on war work are being considered and amounts are not booked over the rdinary purchases of the past.

Cincinnati—It is thought here that the production and the manufacture of automobiles will probably reduce the melt in some foundries so that they will have to seek work of the more essential nature.

St. Louis—The chances of obtaining a supply of pig iron for factories in this district that are not on war work appear to be more remote than ever. A few producers expect the belief that they may have something to sell after the first of the year, but they can promise nothing definite, and they are not willing to book any orders. Stove manufacturers and other makers of specialties outside of the war list are rapidly nearing the close of their supplies of raw material. The way in which they have gone after scrap iron has resulted in a pretty fair cleaning up of all the material suitable for their needs, and the scrap situation in the near future will not be much better than the supply of pig iron.

Philadelphia—In a good many cases here the Government allotment of foundry iron is quite up to the ability of the melters to turn it out, so in that case there is not going to be any selling done. Several of the furnaces are down for repairs on account of labor disabilities.

Pittsburgh—The return of cooler weather has not yet brought about any recoveries from the falling off in production. Stove makers are making strong efforts to secure iron, but the furnace interests are declining to ship to them until they have been given some standing by the Government.

CONDITIONS COULD HARDLY BE WORSE

Calgary Paper Prints Drab Picture of Conditions In Western Mining Town

The Calgary *Herald* is publishing reports of Bolshevist plots which contemplate interference in the mining industry of Drumheller and the *Albertan*, though careful to point out that there has been no confirmation of the reports of the *Herald's* correspondent, declares that if there is any place in Canada where Bolshevism might be expected to find a foothold, that place is Drumheller. Here is the picture of conditions at Drumheller as painted by the *Albertan*:

"Almost every condition conducive to unrest is to be found there. The conditions of labor are such that the population is largely transient; the town is new and the housing is indescribably bad; the community is poorly organized and there is an absence of any feeling of civic pride; the laws are loosely enforced and the liquor laws are not enforced at all; it is known as the freest center of illicit liquor traffic in Western Canada; it is the Mecca of bootleggers, thugs and drug fiends from all parts of the country, and there is little or no attempt either to restrain crime or to construct good social organization. A large part of the mining population is foreign, and the condition of the public mind at the present time is such that there is neither sympathy for nor understanding of these people. Almost every public policy in the last twelve months has tended to alienate, exasperate and rouse the foreign population. They have been disfranchised, suspected, and in some instances exploited; almost everything which could be done to alienate them has been done.

"The mining population of Drumheller is about 30 per cent. British and 70 per cent. foreign. Over 35 per cent. is Italian, between 15 and 20 per cent. is Austrian, Greek, Serb, Swede, negro, etc. Dangerous enemy elements are not likely to have the upper hand in such a population but the soil is such that seeds of trouble once planted, might thrive prodigiously."

The firm hand of authority is required, says the *Albertan*, not only for the suppression of inflammatory enemy propaganda, but for the enforcement of ordinary law and order. It observes that the mine operators realize some of the immediate dangers, as evidenced by plans they are now making for the improvement of housing conditions and the provision of educational facilities. The *Albertan*, however, holds that the provincial Government also should act and calls upon it, not only for the better enforcement of law, but also for the establishment in the district of a well-equipped hospital and the adoption of a suitable programme having regard to the health of the workers.

VERY KEEN DEMAND SUSTAINED FOR ALL GRADES OF SCRAP METAL

AUTHORITIES in the United States are beginning to wonder how with four million men in France they are going to double the ordnance programme. The production of pig iron is not keeping up with the excessive demands that are being made on it, and while at the moment the scrap iron situation appears a little easier the drain on this material will mean that the yards will soon again be near the stage of depletion. Detailed reports on the scrap iron situation for the week show the following:

Pittsburgh—A large number of the consumers in this district are short of old material, and they are not able to cover their requirements fully. Many of the dealers report that they are not able to get tonnages, and some yards have on hand only a small fraction of the stocks they had some months ago. There has been an increased demand for stove plate, which is being bought whenever available at the maximum price of $29. One consumer in this district recently bought up 2,000 tons of this grade for which he paid the top level.

New York—There has been a continued demand here for cast scrap during the past week, and as a result it is not very plentiful just now. At the present writing supplies of turnings and also low phosphorus scrap appear in better volume than the majority of other lines.

Cleveland—The scrap trade generally here is rather dull, as a result of the vacation season, and in nearly every case demand is nearly nominal. Stove plate and similar grades of scrap are in less demand of late, but the prices generally are holding at the old level.

Chicago—One thing that is very noticeable here is the small amount of scrap being brought out by any of the transportation companies. In fact 500 tons offered by the Chicago Great Western Railroad is the only thing available at the present time.

Cincinnati—There is a brisk demand here for almost every kind of scrap at present with the exception of stove plate. and cast iron borings. Neither of these lines are holding very firmly to old prices.

St. Louis—Although there is a very big demand here for nearly every line of scrap, there is not a very large volume of business passing. The reason for this seems to be that the yard men are holding out for very high prices which the consumers are not willing to pay. On top of this it must be noted that yard stocks here are not very heavy and the holders are not particularly anxious to part with them for fear that they cannot replace them at the old prices. The whole territory around here has been scraped pretty bare of everything that generally goes into the discard heap, and the general economy that is being practiced in almost every line has a decided tendency to cut down the amount of scrap material coming into the market.

Philadelphia—The fact of the thirty-day embargo on the shipment of turnings to brass furnaces is being watched with interest here, and the feeling is that the rolling mills will be able to buy large quantities as a result. In fact some of the mills are hoping to accumulate tonnages for future use.

Birmingham—There has been a very decided demand here for anything in the nature of heavy melting steel. One of the large home consumers was in the market here for a few days ago, offering from 50c to $1.50 per ton more for a large tonnage contract than for a few hundred tons. A decided improvement in the whole situation is looked for here.

TURNS OUT FIRST RIVETLESS SHIP

Electrical Welding Has Been Used In Putting the Plates Together

Building of a steel ship without rivets has been effected in a shipyard on the south coast of England, and its construction may mark a new era in the shipbuilding industry. A process of electrical welding was used for joining the plates, in place of the usual riveting and caulking. By means of an electric arc, the joints are submitted to intense heat, and the plates are fused together. The process is not entirely new, as auxiliary work has been done in the past by electric welding. During the last year, developments have been made which have permitted of the extension of this method in ship construction. A saving of between twenty and twenty-five per cent. is saved in both time and material, judging from experimental work done on the new vessel just launched.

The general adoption of electrical welding in shipbuilding would permit a material speeding-up of production. The electric process is particularly economical in the assembling of bulkheads, deck structures and other interior work. The United States is keeping in touch with the developments in this work in Great Britain, and arrangements are under way for the construction of several 10,000-ton standard ships by the same process. These large vessels will contain about 2½ per cent. of the number of rivets originally intended, while the British boat was absolutely rivetless.

CARGO STEAMER LAUNCHED AT VICKERS'

Marked Activity in Connection With Marine Work at Big Montreal Yards

The successful launch of the S. S. "Samnanger" took place at the works of Canadian Vickers, Limited, recently. This makes the third launch from Canadian Vickers yards since the present open season of navigation.

The dimensions of the "Samnaner," which is a 7,000 tonner, are as follows:

Length, 380 feet; breath, 49 feet; depth, 30 ft.

The "Samnanger" is a sister ship to the "Porsanger," which was recently delivered by Canadian Vickers, Limited, to Messrs. Furness, Withy & Co. of Montreal, who are acting as managers on behalf of the British Government.

It is expected that the "Samnanger" will be completed within two or three weeks.

The vessel was launched by Captain H. Jonassen, of Bergen, Norway. As in previous cases there was no ceremony.

The rapid production now going on at these works was strikingly evidenced during the launch. On the dock their latest ship, the "War Earl," was being painted after having run her steam trials last Thursday, while the sister ship, the "War Duchess," was lying in the basin with all machinery on board, getting ready for trials to take place in about two or three weeks.

There is, therefore, every indication that at the end of the present month Canadian Vickers' yard alone will have completed and handed over four 7,000-ton cargo steamers, while on the berths there will be five other vessels, several of them in an advanced stage of completion.

STEAMER WEXFORD PROBABLY LOCATED

Speculation Revived Concerning Fate of Vessel Lost in Big Storm

Goderich.—What is considered the first authentic information of the whereabouts of the steamer Wexford, lost in the great November storm of 1915, was brought to port by the captain of the steamer Mariska. On his course from Chicago to Goderich he sighted and passed within twenty feet of two spars, both at approximately the distance apart the spacing of the Wexford's spars would indicate. Both of these were seen distinctly in the fall of the water between seas, one shorter than the other, with the after spar slightly bent. His familiarity with the vessel when trading on the upper lakes strengthens his conclusion that this can be none other than the Wexford. The location is 15 miles northwest by north of Point Clark, and 16¾ miles northwest of Kincardine.

The last seen of this vessel was on the fateful Sunday when the Kaministiquia, which had left Goderich that morning, had met the Wexford about the middle of the afternoon, then on her course for Goderich. All that had previously been found was a lifeboat and several bodies which came ashore near Grand Bend, thirty miles below here. From the alleged location of the vessel it is apparent that she headed into the northerly storm, but had not made many miles before foundering. The vessel's spars now indicate that she was finally heading down the lake.

SHARP CRITICISM FOR U.S. AIR PLANTS

Senate Committee Talks Straight in Announcing Result of Investigations

Washington.—Recommending one man control of aircraft production, speeding up of production, encouragement of invention and reduction of profits on future contracts, the Senate air craft subcommittee submitted its report to the Military Affairs Committee.

The investigation disclosed a waste of money and lack of common sense policy early in the war, the committee declared. It said that while many "disappointing results" were disclosed, "much has been accomplished, and the committee is glad to report that while it believes there are many things yet to be remedied, nevertheless we are approaching a period when quantity production of planes may soon be hoped for."

Three primary causes of failure of the aircraft programme to measure up to the army's needs were set forth in the report which was read to the Senate today. They are:

1. That the airplane programme was largely placed in the control of the great automobile and other manufacturers, who were ignorant of aeronautical problems.

2. These manufacturers undertook the impossible task of creating a motor which could be adapted to all classes of flying craft. It is not too much to say that our airplane programme has been largely subordinated to the Liberty motor.

3. We failed at the beginning of the war to adopt the commonsense course of reproducing the most approved types of European machines in as great numbers as possible. This should have been carried on coincident with the production of the Liberty motor. This sound policy has very recently, but after a lamentable lapse of time, been adopted.

With the British navy in war time: Upper left hand, boat drill; upper right, fusing a shell; lower left, cutting with oxyacetylene torch; lower right, diver at work.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton		.....
Victoria		50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.

	C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	125 00	125 00
Spelter	11 00	11 00
Lead	10 50	10 00
Antimony	15 50	18 00
Aluminum	50 00	58 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 36

	Black	Galvanized
Standard Buttweld	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19
Standard Lapweld		
2 in.	29 97	36 45
2½ in.	45 05	55 28
3 in.	58 91	72 29
3½ in.	73 60	91 54
4 in.	87 20	108 45
4½ in.	99 06	123 82
5 in.	115 40	144 30
6 in.	149 80	187 20
7 in.	195 20	243 95
8L in.	205 00	256 25
8 in.	236 20	295 20
9 in.	282 90	353 25
10L in.	262 40	328 00
10 in.	337 80	422 30

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Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES

4" and under, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	25 50	24 50
Copper, heavy	25 50	24 50
Copper, wire	24 50	25 50
No. 1 machine composition	23 00	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	26 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs	9 00	8 50
Cast borings	12 00	12 00
Stove plate	26 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	8 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 ... add	20
Machine screws, o. and fil. hd., brass ... add	25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ... plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws ... list plus	20
Collar screws ... list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ... add 40,	10
Cold pressed nuts to 1½ in. ... add	$4 50
Cold pressed nuts over 1½ in. .. add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

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CANADIAN MACHINERY
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Volume XX. No. 9. September 5, 1918.

Strength of Materials an Interesting Study

Necessary That Mechanics Should "Know Why" and Take Nothing For Granted—A Man Who Knows Arithmetic Can go Ahead and Work Out All the Everyday Problems of the Trade

By DONALD A. HAMPSON, Assoc. Mem. Am. Soc. Mech. Eng.

THERE exists an erroneous impression that the subject of "Strength of Materials" is beyond the person of ordinary education and is very difficult at best. This belief has kept many mechanics from delving into the subject at all, believing that a long period of study of preliminaries is needed to prepare one to master the intricacies of strength of materials. As a matter of fact, any one with a good knowledge of arithmetic can follow and do all the problems encountered in everyday work. At the present time when men far past the usual studying age are having new responsibilities thrust upon them and unusual opportunities for advancement are all about, a knowledge of the theory underlying so much of construction work is of the greatest assistance.

And so it is with younger men and mechanics of all kinds. The machines they run and the materials they work—fundamental rules were the basis of the shapes and sizes; and, in repair work, an application of the same rules will tell why this part broke or that piece bent. Of course, we hear it said that "that rod ought to have been heavier to stand the strain," and "if I were making that bracket I would make it thicker in the top web," but could we tell why so much metal gives greater strength when so placed or just what size of rod is safe for a particular function and have our designs stand the scrutiny of the mechanical world, knowing our figures are correct and not based on snap judgment alone? It is very true that millions of parts are and can be designed without the application of theory; it is equally true that all major parts should be amply strong and safe—but that is no excuse for giving to them twice the weight that they need.

Two examples from the automobile manufacturing field serve as illustrations. First, the Ford car; the Ford has carried to an extreme the idea of making each part of material of the greatest strength and of scientifically distributing that material to offer the greatest strength with the least weight. Second, a New England firm that has now fallen into other hands; half a dozen fortunes were lost in the business in as many reorganizations in an effort to make and sell a car that was designed and built on "experience" without the aid of a single technically trained man, while the competing cars all had that advantage. The point we wish to make is that any person in the machine shop field can see the why and wherefore of a hundred things that he always took for granted, by a working knowledge of strength of materials, and one of the most valuable assets for promotion is an ability to cope with problems in that line.

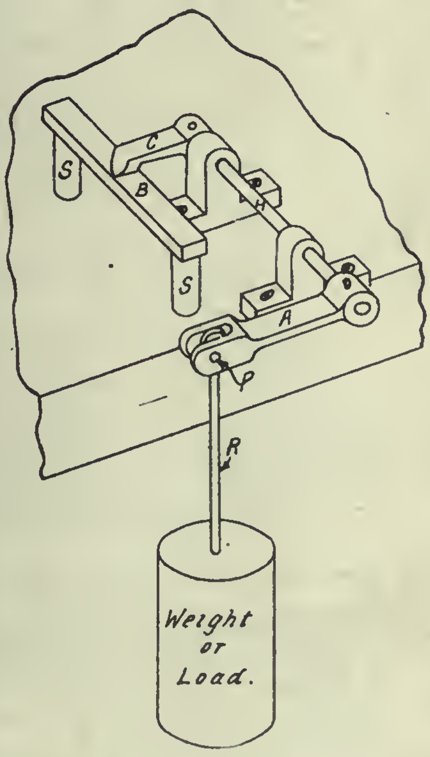


FIG. 1—DEVICE ILLUSTRATING SOME OF THE PRINCIPALS OF MECHANICS.

Experimental Model

Fig. 1 shows a device built for experimental purposes. It will be seen that the weight is suspended by the arm A and the rod R, the former pinned to the shaft H which also has an arm pinned at the far end. This arm bears on the bar B which rests on the blocks S, S standing on the bench. Any apprentice will tell you that the blocks finally transmit the effect of the weight to the bench and that if the blocks gave way the weight would drop. The same apprentice would tell you that if the blocks were of too weak material they would crush or squeeze together, that the bar B would bend if it were not stout enough, that the arm C would bend as would also the arm A, that the shaft H would twist if it were not strong enough, that the pin passing through the rod end and A would cut or shear off if it suspended too heavy a load.

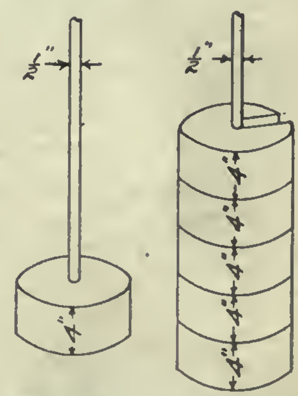


FIG. 2—THE RIGHT HAND ROD IS STRESSED TO FIVE TIMES THE LEFT.

Knowingly or not, the aforesaid apprentice has analyzed the forces and their effects in the various members of the device. Such analysis must precede most calculations in strength of materials or else the effect of the forces must be known or assumed. But in-

1	Rod R.	Tension.	Pull Apart.
3	Pin P.	Shear	Cut Off.
	Shaft H.	Torsion.	Twist.
	Bar B.	Flexure	Bend.
2	Posts S	Compression.	Squeeze Together.

TABLE I.

stead of saying that the rod would pull apart, we say that it is "stressed," and that the name of the stress is "tension." Just so with the other parts, there is a correct technical term for the lay term as applied to the stress in every part. Table 1 gives the technical term for each

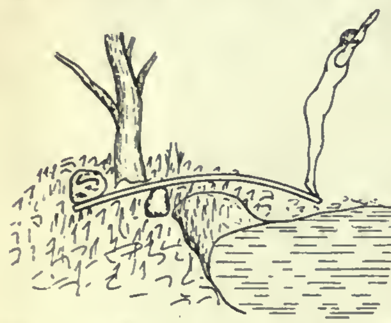


FIG. 4—STRESS IN BOARD DUE TO WEIGHT OF SWIMMER.

case and, for comparison, the lay term is added.

Loads and Stresses

In strength of materials we have to deal with the effects of weights, pressure, blows, etc., which are grouped under the term of "loads"; the term force is also used though there is a distinction which however we need not consider at the present moment. These loads, in forces, act in different ways, and, according to how they are applied to a part, tend to distort that part—that element in the part which resists the distortion is called a "stress," and the part itself is said to be stressed. Ordinarily there is no visible distortion, but the part is stressed nevertheless. In Fig. 2 one weight is suspended from the left hand rod and five from the right hand rod; both rods being of the same size, it is easily understood that the right hand rod is stressed five times as much as the other.

A stress is really an internal force resisting any change of form. A most excellent example of a stress as a force is seen in Fig. 3, the familiar spring board of the swimmer; normally straight, it bends under the swimmer's weight and the stress so set up loses no time in returning the board to original shape and incidentally giving the impetus for the dive. A body in repose usually is not stressed at all except from its own weight, as witness the spring board above which normally would extend right out straight.

In shop parlance and in conversation generally, the word "strain" is used for stress which is the correct term. If the load on a part is so great that it does not return to its original shape, the amount of the deformation would be the "strain." The correct engineering term should always be used, and as stresses are the most frequent and are a leading factor in the subject, the student ought to drop the incorrect term absolutely except when the infrequent strain is encountered.

Measuring Stresses

Stresses are measured in pounds per square inch, taking the area of the cross section for measurement. Thus in Fig. 1, if the area of the rod A is one-half square inch, and the weight is 1,000 lbs., the stress in the rod is 1,000 lbs., which is at the rate of 2,000 lbs. per sq. inch, and the latter is the value that would be used in computing or comparing with the known strength of the material in the rod. The steel in the rod has a strength of about 60,000 lbs. per sq. inch, and 60,000 and 2,000 (not 1,000) are the values used in determining the relative strength of the rod to bear the load of 1,000 lbs.

No matter what the nature of the stress—any of the five detailed in Table 1—the square inch basis is employed, and if one square inch (of area) will resist a given force then five square inches will resist five times that force if the force is applied in the same manner. If a compressive force were applied to each of the bars in Fig. 4 they would be stressed the same as would a bar of 2 square inch area.

It is a simple matter to determine the stress produced by a single force—whether it is tension or shear or torsion—acting in a machine or when the machine or structure is being designed. Though there are five of them named in Table 1 modern practice and theory reduces these to the three that are numbered, i.e., tension, compression, and shear. Torsion is considered as a shearing stress and flexure as a combination of tension and compression. A good illustration of the combination of stresses in flexure (bending) is shown by Fig. 5, A and B; the piece shown at A has a notch cut part way through each side; at B the same piece is shown bent, and, while the ends remain intact, the upper notch has closed and the lower one has opened wider proving that half of the fibers have stretched and the other half have compressed.

Some materials when stressed are very strong, while others are weak under the same kind of stress. Cast iron shows the widest difference in this respect as can be noted by referring to Table II, which shows that this metal is several times as strong in compression as in tension. Practical applications of this property are seen in countless designs—

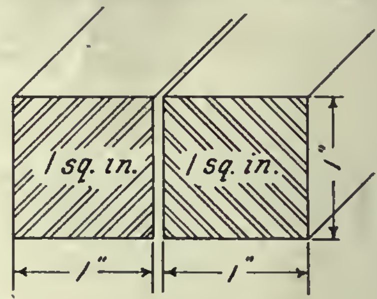


FIG. 4.

Fig. 6 is a frame for a punch with the stresses marked as they occur in working; the iron on the inside curve is in tension, "just what it should not be because there the load is greatest," you will say, and this is true, but to offset this the frame is made with a thick wide rib at the inside which adds enough metal so that the stress per square inch is within the safe limits of cast iron. The point where the stress changes from tension to compression is at the intersection of the two lines.

Fig. 7 shows the connecting rod of a steam engine. Any mechanic will tell you that this rod should be made of steel or wrought iron, never of cast iron, because cast iron would pull apart on the return stroke and wouldn't stand the jar—reference to the table again proves that cast iron is a poor material in tension. The connecting rod is an excellent example of a part that is stressed first one way and then another—compression on the forward stroke and tension on the

MATERIAL.	TENSION.	COMPRESSION.	SHEAR.
Steel.	60,000	60,000	50,000
Cast Iron.	15,000	80,000	20,000
Timber.	10,000	7,000	2,000

TABLE II.—ULTIMATE STRENGTH.

MATERIAL	WEIGHT OR STEADY LOAD.	SHOCKS & FALLING LOAD.	STRESSES IN BOTH DIRECTNS
Steel	5	12	8
Cast Iron	6	20	16

TABLE III.—FACTORS OF SAFETY IN COMMON USE.

return. The table shows why steel is adapted to such uses, being practically as strong in one as the other.

Tension, Compression and Shear

Calculations for parts in tension, compression and shear are very simple. They are based entirely on the area of

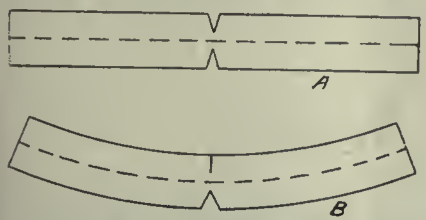


FIG. 5—SHOWING EFFECT OF LOAD IN STRESSING THE FIBRES OF A BEAM.

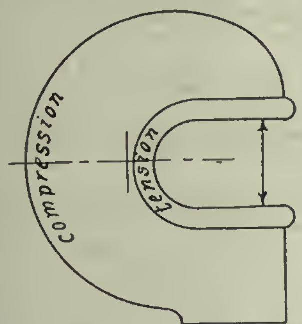


FIG. 6—FRAME FOR A PUNCH SHOWING STRESSES.

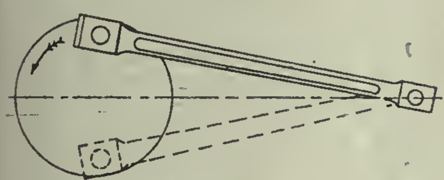


FIG. 7—CONNECTING ROD FOR STEAM ENGINE.

metal involved and the strength of that metal. As in Fig. 4, if one of the bars will resist a load of say 20,000 lbs. per square inch, two of the bars or any multiple of the unit area will resist just that many times 20,000 lbs. In the case at hand it happens that the area of section of the bars is 1 square inch, and no matter if the stress is tension, compression or shear, the two would resist 40,000 lbs., whether separate bars or joined in one of the same area.

In building construction we find parts in compression that do not come within the simple rule just stated. These are long members such as columns and supports which, because of their length have a tendency to bend in the middle under a load and have to be specially designed with this in view. They are covered by a more complicated formula.

Shear is a stress that takes its name from common household shears. The cutting of sheet metals and the numerous press punch operations are machine shop processes in which materials are so stressed on such work, the object is to sever the metal (not to have it strong enough to resist) and the mathematical side appears when it is desired to know how much resistance the part will offer to cutting and how powerful a machine will be required for the work; here again the area of the cut surface multiplied by the strength of the material gives the total resistance offered.

The commonest applications of machine parts under shear that are supposed to be amply safe against cutting off are found in forked joints such as at P in Fig. 1. Here if the pin were too light the eye end of the rod would cut it off at each side and the rod and weight would fall—the pin would be cut into three pieces, each of which would be left in the original hole. Pin connected bridges and the multitude of linkages found in machine construction all fall in this class. The arms A and C in Fig. 1 are connected to the shaft by taper pins; these pins resist a shearing stress, and if too small for the load they will cut off, the result as shown in the section at Fig. 8.

Table of Breaking Strengths

In construction and design it is customary to assume that the materials used have a certain strength per unit of area. The values given in Table II are fair average values, but different grades will show a wide variation each way from these averages. To the beginner this variation puts him all at sea and he thinks tables are worse than useless—the facts however are that steel (for instance) used for structural shapes is of such composition and manufacture that its strength does not vary more than one or two per cent from a known value, the same is true of steel used for shafting and for piano wire, and so on throughout a score of well-defined grades covering all the common uses. Engineers' handbooks gives these values in detail. In designing, steel of a certain strength is specified and the calculations for parts and sizes are made accordingly, then when the work gets to the shop the proper steel is selected, or if not in stock it is ordered from the mills to be of that strength.

The values in Table II are the "ultimate" or breaking strength of the materials. Naturally no one would want to load a piece to the breaking point, but this is the common way of stating the relative strengths and forms a more satisfactory basis for calculations than to try to table different materials under different kinds of forces with the safe loads they should bear. Common sense tells us to make a part safely strong, i.e., not to stress the part to its ultimate strength. In engineering we say the part is given "a factor of safety." Thus, if the load on a beam is going to be 2,400 lbs. and the beam is made heavy enough to hold 9,600 lbs (at which load it would be stressed to the point of failure) then we say the factor of safety is 4.

Safety Factors

The half inch rods in Fig. 2 serve as an illustration of the factor of safety. One of them holds five weights of equal size and the other one weight. Now the rod at the right does not break under its load but it is nearer breaking than the rod at the left because five times the weight puts five times the stress upon it and that stress is five times as near the ultimate strength of the steel: Assuming that ten of the weights would break the rod, then the right hand rod has a factor of safety of $10 \div 5 = 2$ and the left hand rod has a factor of safety of 10. A part that has a factor of safety as low as 2 is not considered safe for any purpose, and though there are millions of minor pieces so made, good design and safety coupled with a reasonable life of wearing surfaces demand a factor as high as 4 in all cases and often one much greater than that.

Table III gives factors of safety for a number of common uses. It will be noticed that where there is a steady load considered the factor is much lower than when the load is applied suddenly. Thus a part, as for instance a floor beam, is able to withstand a weight that is carefully placed and left there far better than the same weight if it is dumped off a truck on to the floor. A load suddenly applied puts twice the stress on any member that the same load would if existing merely as a weight. Stresses that alternate in direction need a larger factor of safety than when acting in one direction only; the connecting rod of Fig. 7 is a good example of a part so stressed and the pieces of wire that we see so often broken by bending back and forth in the hands is another. The designer sometimes chooses his own factor of safety arbitrarily, but it is better to use those given in Table III, which represent first-class practice. Every case may be resolved into one of the three classes named in the table.

Combination of Stresses

It has been stated that the stresses encountered in beams bending are but a combination of tension and compression; it should also be stated that the simple rules for these kinds of loading do not apply in the case of beams because un-

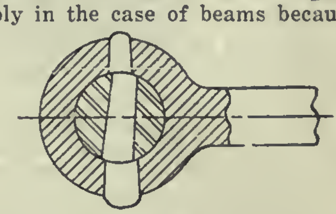


FIG. 8.

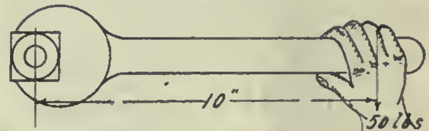


FIG. 9—ILLUSTRATION OF CANTILEVER LOADING.

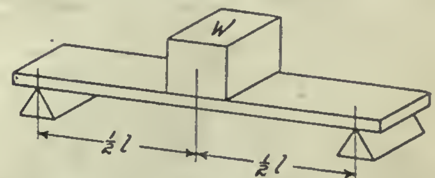


FIG. 10—BEAM WITH SIMPLEST LOADING.

der bending stresses certain parts of the beam offer greater resistance than others. The punch frame is an example of this.

The punch frame comes under the head of beams, even though it bears no resemblance to that term as used in carpentry. Any part under a bending stress is called a beam. The wrench in Fig. 9 is a cantilever beam, so is the nose of a lathe spindle, the bed of a lathe is a beam resisting the weight of parts and the pressure of the cut, a shaft is a beam supported at the hangers and loaded by pulleys and belt pulls. The plank shown in Fig. 10 represents one of the

The resisting value of each square is the product of its area by the square of the distance to its centre which gives for each square in A a value of ½ x ½ x 1 = ¼ and a total value for the entire section of 12 x ¼ = 3. The value of B is made up of the sum of the products similarly obtained — 4 x ½ x ½ x 1 (as

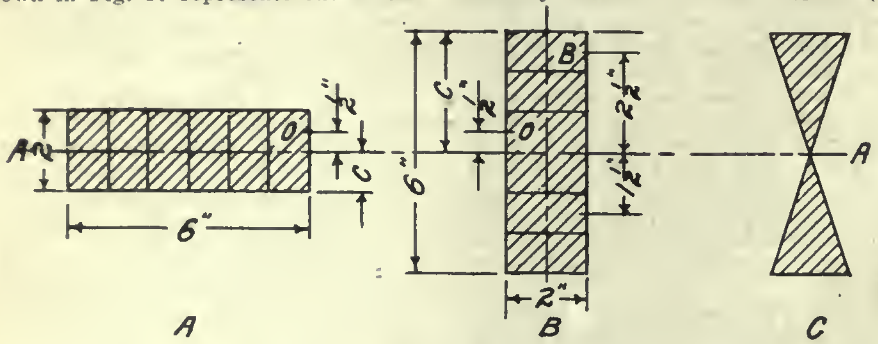


FIG. 11.

simplest beams typically loaded and supported; the length of this beam is the distance between the ridges of the triangular supports and the load W is placed midway of the supports.

Relative Strength of Beams

To show the method of determining the relative strength of beams and of the same beam in different positions, the three figures of Fig. 11 have been drawn. A and B are two views of the same 2 x 6 beam laid flat and on edge. The center line A, A, passes through the center of each; in beam calculations this line is called the "neutral axis"—the neutral axis passes through the center of gravity of any figure, which is also the horizontal center line of a symmetrical figure. There is a vertical as well as a horizontal neutral axis for every cross section but the usual method of calculating is to consider the beam laid so the working neutral axis is horizontal.

The "neutral plane" is the imaginary surface that would be formed if the neutral axis were continued throughout the entire length of the beam. The dash line in Fig. 5 indicate the position of the neutral plane as viewed from the side—it will be noted that the line is in the center of the beam both at A and B—it is the plane where the fibres are neither stretched nor compressed. An important fact in connection with the neutral plane is that none of the fibres of the material lying exactly on the plane have any value in resisting stresses, while those farthest from it have the greatest resisting value.

Turning again to Fig. 11, A and B, it will be seen that the sections have been divided into squares 1 inch on a side, a way that is made more accurate by decreasing the size of the squares. The area of the squares and the distance from the neutral axis to the center of each square are the factors in the calculation. In this example the area of all the squares is 1 sq. in.; at A, the distance of all the squares from the neutral axis is ½ in., while at B there are three distances and only four of the squares are ½ in. from the neutral axis.

before) plus 4 x 1½ x 1½ x 1 plus 4 x 2½ x 2½ x 1 = 35.

The sum of these products—3 in one case and 35 in the other—is called the "moment of inertia," a value of the highest importance in beam calculations (the words moment and inertia as here used have no connection with other meanings and applications). Another value frequently used is obtained by dividing the moment of inertia by the distance from the neutral axis to the extreme fibre of the section (as the distance C in Fig. 11). The result is called the "section modulus." The section modulus of A then would be 3 ÷ 1 = 3 and the section

FIG. 12—ANVIL AND MEANS FOR SUPPORTING.

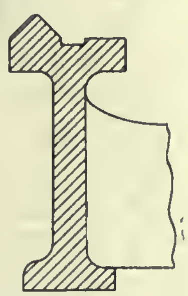


FIG. 13—SECTION THROUGH LATHE BED.

modulus of B would be 35 ÷ 3 = 11 2-3. The section modulus is often called the "resisting inches" and is a value more readily comprehended by referring to Fig. 11, C; C has much less area than B, but if each of the squares in B had an equal resisting value and that value was like the value of the extreme fibres in B, a beam of the size of C would be as strong as the beam B which is twice as heavy. The section modulus as shown at C is a graphic representation of the actual load-resisting value of every particle of material in the beam B—the fibers on the center line have no strength at all but as we move away their strength increases as rapidly as the increase of size of the triangles in C whose apexes are on the center line.

As shown in the preceding paragraph the section modulus of the beam on its side is 3 and of the same beam on edge is 11 2-3; this is the actual ratio of their strengths. If we could obtain the section modulus directly we would not need the moment of inertia, in fact the latter is chiefly useful as a means to an end. In using formulas for calculating the strength of beams we always find either the moment of inertia or the section modulus and we use the values for these according to the size and shape of the particular beam. Instead of having to divide each section into minute squares and obtain the moment of inertia in this way, there have been worked out brief formulas for all structural shapes and regular cross sections, and it is then only necessary to substitute actual sizes to get the resistance of the beam. In most engineering works the moment of inertia is represented by I, the distance from the neutral axis to the extreme fibers by c, and the section modulus by $\frac{I}{c}$—which fraction shows the division we have just been discussing.

Distribution of Metal

The applications of the proper distribution of material in beams are almost too numerous to select from. Fig. 13 is a partial section through a lathe bed showing one of the I-shaped sides which has a deep web and flanges at the extremes of the web—a shape that gives a high value to the section modulus with a comparatively light weight. The familiar U clamp used for fastening work on planers and drills and boring machines is a lowly example of a piece where we should stand the beam on edge to get greater stiffness, something the blacksmith should do when forging these necessaries.

Another instance, but one that is not rectangular, is shown in Fig. 14. It was desired to convert a solid spindle of a lathe into a hollow one but it was feared that cutting away the metal would weaken the spindle too much. The size of the spindle at the front bearing was 2 ins., at the rear bearing 1¼ ins., and a ⅞ in. hole was wanted. Substituting these values in the formulas for solid and for hollow rounds, the section modulus for the front bearing is found to be .785 and .756 respectively, showing the remarkable fact that the spindle is weakened but 3 per cent. by drilling the hole

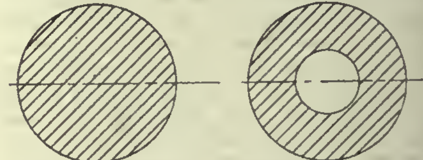


FIG. 14—SOLID AND HOLLOW ROUND SHAFTS.

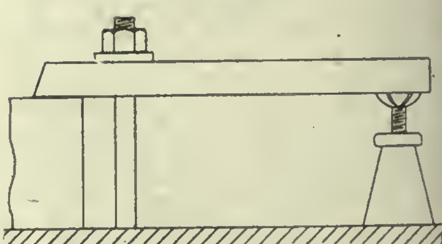


FIG. 15.

through. At the rear bearing the results are .122 and .076, which is a loss of strength of 37 per cent.; a greater proportionate loss because the diameter of the outside is nearer that of the hole but a loss that did not affect the strength of the spindle seriously because of the nature of the work and the distance of the rear end from the point of application of the load.

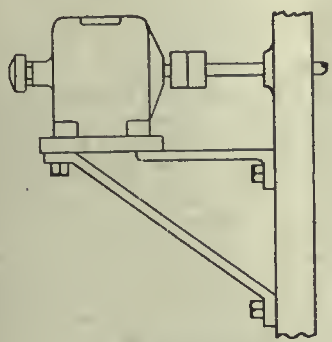


FIG. 16—MOTOR BRACKET

The example just cited is a typical one for tubular or box construction—the farther away from the center that the metal can be placed the stronger will the member be; also the metal at the exact center has no resisting value and very little within quite a distance of the center. There is a popular fallacy connected with tubing, however, that will bear correcting at this time. A tube is not stronger than a solid piece of the same outside shape and the same weight.

The matter of stiffness must also be considered in connection with beams. While a beam might be strong enough to carry all the load that ever will be put upon it and have a good margin of safety, it still might spring or vibrate so much as to give altogether unsatisfactory results. A good example of this is shown in Fig. 12 where an anvil is located on a floor that would be considered substantially constructed but which would vibrate too much for the blacksmithing to be done. The shop floor is located but a few feet above the ground and the natural footing therefore was to run a post down to a masonry foundation, the post bein gan example of a part in compression, subject to a steady load (the anvil, block and flooring) and to shocks from the hammering.

Stiffness, the proportioning of beams, the effects of loads differently placed—all these follow in easy succession when the elements become firmly placed in the mind. And the work is not hard to understand. Interesting examples are all about in shop work, factory construction, repairs and design—such as indicated by Fig. 16 where it was required to apply a motor weighing 900 lbs. to a special machine; it had to be located as shown and the designing of suitable brackets and frame was given to one of the shop men who had been "studying nights." The arrangement proved quite successful and earned complimentary remarks for the designer from engineers who later viewed the work. This is but an instance of the opportunities ever present for an application of Strength of Materials.

TEXTILE BELTINGS

By Mark Meredith

One of the effects of this, as of previous wars, has been to send up the price of leather. Prices, as a matter of fact, were advancing before the war, but they are now about 33½ per cent. above the normal. This has led to a big increase in the cost of all mill supplies derived from leather, and has also caused manufacturers and other users of power to prosecute inquiries as to the relative efficiency of other means of power transmission. Thus the various forms of textile beltings on the market have been given a unique opportunity of proving their efficiency and economy. No transmission can be termed cheap, no matter how low the initial cost, if it involves loss of power. Efficiency is the first requisite of any product that has to compete with the older style of power transmission by means of leather. As a matter of fact, textile belting has been in practical use for about half a century, and during that time has given abundant proof of its durability and efficiency.

The best types of textile belting on the market are made either of hair or balata. Hair belting, which is 50 per cent. cheaper than leather is simply a solid woven fabric made up in different thicknesses and composed of certain grades of hair and woolen yarns combined with cotton. Balata belting is about 25 per cent. cheaper than leather. It is made from very strong cotton cloth known as "duck," which is saturated with a soluation of balata, folded to the required width and ply under heat, and then stretched on powerful straining heads, where it is allowed to cool and set dead under tension. This prevents shrinkage, and except within the narrowest limits, any possibility of stretch afterwards. Balta, it may be explained, is a milky latex obtained in the same manner as rubber, by tapping. It is, indeed allied to both rubber and gutta-percha, but has certain properties peculiar to itself. It is waterproof, but has only enough elasticity to prevent brittleness. Sheet balata, which obtains the highest price, is obtained from the Guineas, and block balata from Venezuela. The hair belting is a very efficient form of transmission. One of its virtues is that it is not susceptable to atmospheric conditions as other forms, whilst its adaptability makes it particularly suitable for outdoor work. In textile factories it has long been used with success for mule down drives, top-straps and for ringspinning frames, but its grip has been found too positive for loom straps, which are required to slip off the fast pulley quickly when the loom stops. The condition of the loom, however, is exceptional, and what is a virtue for leather in the case of the loom would prove a serious loss of power in cases where regular driving is essential. Balata belting in consequence of its method of construction possesses a very good driving face. It is possible to add to the number of plies and thus increase the thickness so as to transmit the highest loads. In that, too, it has an advantage over leather. Moreover, it can be made to any length, of an even strength throughout, and it is therefore largely used where it is necessary to reverse the drive, or where guide pulleys are employ-d. The best practice is to use thin belts as there is less danger of rupture between the plies in bending round the pulleys. A thin belt clings to the pulley much better than a thick one. Balata belting is especially suitable for pulp and paper mills, engineering shops, and places where heavy continuous driving is necessary.

Future of Textile Belting

The prospects for making of textile beltings are exceedingly bright, seeing that the German and Austrian supplies are cut off by the war. The competition of German manufacturers was exceptionally keen, as they were content to work on the narrowest margins, while the usual German methods were employed on allowing consigned goods an exceptionally extended credit. This enabled them in markets such as Italy, Spain, and other continental countries practically to oust English manufacture in the ordinary qualities of belting. Not only is textile belting used to a greater extent for power transmission, but its serviceability for conveying loads from point to point is being proved in an increasing number of ways. In the large stores it is now the universal practice to send goods to be packed and afterwards to their delivery stations along conveyor belts. They are, however, put to much severer tests in quarries and collieries, and to-day textile beltings are being regularly employed for conveying coal, coke, limestone, cement, granite, quartz, chalk clay, sand, and many other materials. This is an age of enquiry, and the up-to-date head of a factory or workshop carefully figures out the cost of his coal bill in comparision with the steam power generated in the engine-room. Let him also look into the methods of transmitting that power, to see if some of the leakage that takes place cannot be lessened by up-to-date driving.

It has been shown by experiment that the sulphur contained in coal in the form of pyrites is not the chief source of spontaneous combustion, as was formerly supposed, but the oxidation of the sulphur in the coal may assist in breaking up the lumps of coal, and thus may increase the amount of fine coal which is particularly liable to rapid oxidation. Even this opinion is not unanimously endorced. In spite of experimental data showing that sulphur is not the determining element in spontaneous combustion, the opinion is widespread that, if possible, it is well for storage purposes to choose a coal with a low sulphur content.

How Hun Plotters Worked in U.S. Before the War

Did Everything Possible to Prevent the Export of Munitions to Allies—How the Whole Thing Has Been Exposed by the U.S. Authorities Who Investigated the Whole Performance

By EARL E. SPERRY and WILLIS WEST for U. S. Committee on Public Information.

ONE chief purpose of the German and Austrian ambassadors was to prevent the export from the United States of military supplies. Since Germany's shipping had been driven from the seas early in the war her overwhelming superiority in accumulated munitions and in power to manufacture was certain to be lost as the passing months brought to the Entente states an increasing volume of American products.

To strike at the very source of these supplies, the American factory, was obviously an effective means to prevent their export, and in a letter to Baron Burian, Foreign Minister of Austria-Hungary, Ambassador Dumba writes concerning this design:

> Besides, a private German employment office has been established which provides employment for persons who have voluntarily given up their places, and it is already working well. We shall also join in and the widest support is assured us.

This German employment bureau had a central office in New York City, Chicago and Cincinnati. It was established early in August, 1915, by the attaches and responsible agents of the German and Austrian embassies. Liebau, its manager, said that "among those who were active in opening this bureau were Professor Kuhnemann, exchange professor at Harvard University, Professor Munsterberg . . . and the German Club of New York City."

Its revenues consisted in part of gifts from private sources. These were solicited, among others, by Dr. Karl O. Bertling, who was provided with the following letter:

> Imperial German Embassy,
> Washington, Nov. 4, 1916.
>
> I hereby permit myself to recommend to you most warmly Dr. Karl O. Bertling, Direktor of the Amerika-Institute in Berlin. Dr. Bertling will take the liberty to lay before you some matters pertaining to the activity of the Central Bureau for German and Austro-Hungarian workmen. This work as well as the collection of funds for its further extension are worthy of all sympathy.
>
> Dr. Bertling is authorized to receive contributions in any amount. Checks are to be made payable to Hans Liebau, Treasurer.
>
> Yours with apecial respect,
> (Signed) J. von Bernstorff.

When gifts began to lessen in amount the two governments concerned had to contribute more liberally to the support of the bureau, and the arrangement made is thus described by Mr. R. H. Otto, former German consul at Kingston, Jamaica:

> I wrote to the German Embassy covering the whole matter and suggesting that the German Government subsidize the Bureau by a regular contribution of funds. I heard nothing of it for months, but one day received a telephone message from Dr. Heinrich F. Albert to see him at his office, 45 Broadway. When I arrived there, he told me the German Embassy had authorized him to supply our Bureau with funds up to $2,000 per month. He then gave me $2,000 in greenbacks, mostly in $100 bills. . . . . Whenever I learned from Mr. Liebau that money was needed for the Bureau, I gave Dr. Albert 24 hours' notice and went and got the money from him. . . . . In all, I must have turned over to Liebau between $24,000 and $30,000.

The pretended purpose of the bureau was to provide employment for German and Austrian subjects who had voluntarily left positions in factories supplying the allies.

Its real purpose is disclosed in the following letter from Liebau to a German employed in such a factory:

> Mr. ——— Sept. 24, 1915.
> Brooklyn.
>
> As we have heard that you are employed in one of the many factories which deliver war material to the enemies of Germany, we wish to call your attention to the fact that according to the notice published in many newspapers, under Section 89 of the German Criminal Code, you are guilty of treason if you are a German subject.

That coercion and intimidation were regularly used by the bureau to drive employees from munition factories has been proved by an examination of over 5,000 letters and other papers in its files. The Austrian government reinforced these efforts by circulating in this country, through the foreign language press, a proclamation which threatened with a penalty of ten to twenty years' imprisonment all subjects who after working in such plants returned to their native land. Captain von Papen also sent out a circular letter of similar import.

Success rewarded these energetic efforts to harass American manufacturers. Liebau's monthly report, made to the German Embassy for February, 1916, contains the following statements:

> Since the Bureau began its work in August, 1915, through February, 1916, 2,828 Germans and 1,638 subjects of the Austro-Hungarian monarchy have been provided for. The total number of applicants is now 8,000. Of these 60 per cent. came from factories producing munition and war material, and 40 per cent. would have been employed in such plants if the agency had not provided for them. . . .
>
> Engineers and persons in the better class of positions. . . . were persuaded by the propaganda of the Bureau to leave war material factories. . .
>
> The commercial employment bureaus of the country have no supply of unemployed technicians. . . . Many disturbances and suspensions which war material factories have had to suffer, and which it was not always possible to remove quickly, but which on the contrary often lead to long strikes, may be attributed to the energetic propaganda of the employment bureau.

Causing Strikes

The strike was a weapon which both the German and Austrian ambassadors intended to use with destructive effect on American industry. Ambassador Dumba, in a letter to his Foreign Office, thus expressed their fundamental purpose:

> It is my impression that we can disorganize and hold up for months, if not entirely prevent, the manufacture of munitions in Bethlehem and the Middle West, which in the opinion of the German Military Attache, is of importance and amply outweighs the comparatively small expenditure of money involved. . .

The most comprehensive and successful effort to provoke strikes was made by Labor's National Peace Council, an organization financed by Franz von Rintelen, who came to the United States early in April, 1915.

The alleged purpose of the council was to express the pacific sentiments of the workers and to prevent the United States from entering the war. At its first meeting, on June 22, 1915, it adopted among others the following resolution:

> Resolved, By the representatives of labor in Peace Congress assembled in the City of Washington, that an organization be and is hereby established, to be known as Labor's National Peace Council, having for its purpose the establishment and maintenance of peace universal by all honorable means. . . .

The president of the council, Congressman Frank Buchanan, wrote to President Wilson the next day, stating that a committee of the council desired an interview in order to acquaint him with the resolutions adopted. The President's secretary replied that, owing to business of urgent importance it had been impossible for President Wilson, during a brief stay in Washington, to see the committee. Buchanan then wrote the following letter, designed to express the pretended spirit and purposes of the council:

> Labor's National Peace Council,
> Chicago, Ill., July 28, 1915.
>
> Hon. J. P. Tumulty,
> The White House,
> Washington, D.C.
>
> My Dear Mr. Tumulty:—
>
> (Opening paragraph acknowledges letter).
>
> Your intimation that the President's time was so fully taken up with matters of pressing importance, that he could not grant an audience to the representatives of Labor, that has made the United States of America the proud nation that it is, in order to permit them in person to demonstrate that the subsidized press, representing organized dollars in America, which is seeking to serve as the volunteer adviser of the President, was misrepresenting Labor's attitude in the present crisis, is tantamount to a declaration that the President is more concerned about the desires of Big Business than he is to discover the heartfelt sentiment of the common people.
>
> As is well known, I, by the vote of the people, was taken from the ranks of America's toilers to serve them in the Hall

of Congress and as their representative to voice their opinion on national questions. As a Trades Unionist I found that the first lesson taught by Organized Labor was to implant in the heart and minds of its members "The Ethics of Humanity and the Sacredness of Human Life."

I thank you, Mr. Tumulty, for your candor. My duty to those I serve leaves me no alternative but to say that so long as they, the people whom I serve, continue to be united in their belief that progress and prosperity is dependent upon religious observance of the scriptural admonition, "and they shall beat their swords into ploughshares, and their spears into prunings hooks; nation shall not lift up sword against nation, neither shall they learn war any more;" just so long shall I continue to rap at the door of the President's private chambers to secure admittance for a delegation of workers "Who Not Only Desire Peace at Home But Peace Abroad as Well."

Awaiting your reply, I have the honor to be,

Very truly yours,

Frank Buchanan.

The pretended purposes of Labor's National Peace Council as stated by Congressman Buchanan were in striking contrast to its real purposes as stated to the jury by several witnesses. Among these was Ernest Bohm, its treasurer and a labor leader, who testified that he was asked by Henry Martin, one of the Council's organizers to assist in provoking strikes in munition factories, and if successful he was to receive $5,000 to $10,000. Labor agitators were hired who visited the munition centers in the eastern part of the United States and caused strikes in several cities, including Schenectady, N.Y., Ilion, N.Y., and Bridgeport, Conn.

The following telegram is a typical report from one of these men to his employer.

July 28, 1915.

H. B. Martin,
Hotel Sherman,
City Hall Square,
Chicago, Illinois.

Organizers from States where war munitions are manufactured were in session in Bridgeport last night. Talked with them. Strikes liable to occur. Reports show that workers are ready to enforce demands. Fresh trouble for makers of general war supplies will break out all over the country.

William Delehanty.

Strikes in other industries, also by railway employees and by marine engineers and firemen, were planned by the leaders of the council.

A serious attempt was made to paralyze America's foreign commerce by a strike of stevedores. One of Rintelen's men had an interview with the president of the International Longshoremen's Union, and other officials were approached. Rintelen agreed to pay the strikers ten dollars a week while idle, and asserted that he could command the $1,035,000 necessary for this purpose. He spent $10,000 on this project, but the strike did not occur.

Along with Lamar, Buchanan, ex-Congressman Fowler, Martin, Monett, and two others, all of whom had assisted in the work of the Council, Rintelen was indicted by the Grand Jury on December 28, 1915, for "conspiracy to restrain the manufacture, transportation, and export of munitions of war." Among the means employed to accomplish these purposes the indictment specifies the instigation of strikes by solicitation, by the dissemination of letters, circulars and newspaper articles, by bribery, and by the distribution of money to labor leaders. Rintelen, Lamar, and Martin were found guilty, and on May 21, 1917, were each sentenced to one year's imprisonment. The indictment against Monett was dismissed and the jury disagreed as to the others.

The amount of money which Rintelen had at his disposal was stated by George Plochman, treasurer of the Transatlantic Trust Co., where Rintelen kept his accounts, to be $508,000, which was transmitted from Germany through the Hamburg-American Line.

A photographic copy of Rintelen's accounts with the Transatlantic Trust Company shows that while Labor's National Peace Council was being organized and operated, he paid out the following sums of $1,000 or over:

April 10 (1915)	$1,000
" 12	1,000
" 13	3,500
" 17	1,000
" 22	2,100
" 28	12,500
May 3	3,500
" 5	2,000
" 11	15,000
" 13	2,000
" 20	1,000
June 4	70,000
July 14	2,500
" 16	10,600
" 20	25,000
" 23	1,000
" 27	20,000
" 31	25,000
Aug. 2	25,000

Under the name E. V. Gibbons & Co. he also paid out the following amounts:

April 22	$3,000
" 26	6,000
" 28	2,500
" 30	2,500
May 17	2,500
" 18	18,000
" 20	4,400
" 25	1,500
" 29	1,300
June 1	30,000
" 7	1,500
" 12	20,000
" 18	25,900
" 24	26,500
" 30	5,500
July 2	2,600
" 8	1,500
" 10	3,000
" 13	7,600

The total of his known expenditures was $468,000, and in return he received almost nothing except an occasional newspaper article attacking President Wilson. Nearly all the strikes which his hired men pretended they had started and for which they received thousands of dollars had quite other causes. Rintelen was shamelessly duped and swindled by his supposed tools.

Pressure on Congress

The hand of the German government was extended to America to influence members of Congress through German-American voters and their sympathizers. The German-American National Alliance had long endeavored to weld persons of German descent in the United States into a compact body, to be used, when desirable in the interests of Germany. After the war began in July, 1914, prominent German-Americans organized and supported other societies which aimed to persuade or intimidate members of Congress into adopting pro-German poilcies.

One of these organizations was the American Embargo Conference, established to prevent the export of munitions. That it was recognized as a valuable tool of the German government and probably received money from Berlin is shown by the following telegram (September 15, 1916) from Count Bernstorff to the German Foreign Office:

The Embargo Conference in regard to whose earlier fruitful co-operation Dr. Hale can give information is just about to enter a vigorous campaign to secure a majority in both houses of Congress favorable to Germany and request further support. There is no possibility of our being compromised. Request telegraphic reply.

The Embargo Conference distributed to voters over 5,000,000 telegrams demanding an embargo on munitions, and at a fixed date 250,000 of these identical messages poured into Washington. The conference paid to the telegraph companies in Chicago alone the sum of $20,000. It also distributed pamphlets and circular letters demanding an embargo and denouncing American makers of munitions.

Although the officers of the conference asserted that it was supported by small popular subscriptions, its cash book shows that the $57,000 received from July, 1915, to June, 1916, consisted of sums varying from $400 to $1,000, and given, as a rule by prominent German-Americans of New York, Chicago, Cincinnati, and Detroit. One gift of $5,000 came from an international banking firm in New York City.

The embargo conference apparently served the German government well, for Count von Bernstorff, in the following telegram to Berlin, requests $50,000 to be spent either on this or a similar organization aiming to force pro-German policies on Congress:

I request authority to pay out up to $50,000 (fifty thousand dollars) in order, as on former occasions, to influence Congress through the organization you know of, which can perhaps prevent war.

I am beginning in the meantime to act accordingly.

In the above circumstances a public official German declaration in favor of Ireland is highly desirable, in order to gain the support of the Irish influence here.

The actual bribery of Congressmen apparently was intended by Franz von Rintelen. According to Meloy, he supplied Lamar with money to be used in procuring the passage of resolutions by Congress which should embarrass the government in the conduct of its relations with Germany. Both Congressmen Buchanan and ex-Congressman Fowler received money for their assistance in attempting to bribe Congress. That such was Rintelen's intention was also stated explicitly by George Plochman, treasurer of the Transatlantic Trust Company where Rintelen kept his accounts.

Causing War With Mexico

Rintelen also tried to prevent the export of munitions by causing war between the United States and Mexico. During his trial at New York City (May, 1917), one of the witnesses, an advertising man with whom Rintelen advised concerning his pacifist propaganda, testified that Rintelen said:

That he came to the United States in order to embroil it with Mexico and Japan if necessary; that he was doing all he could and was going to do all he could to embroil this country with Mexico; that he believed that if the United States had a war with Mexico it would stop the shipment of ammunition to Europe; that he believed it would be only a matter of time until we were involved with Japan.

Rintelen also said that General Huerta was going to return to Mexico and start a revolution there which would cause the United States to intervene and so make it impossible to ship munitions to Europe. Intervention, he said, was one of his trump cards.

Within Mexico itself other German agents have been conducting for many months a powerful anti-American propaganda. Their aims are to destroy American prestige by teaching that the United States is impotent, unable even to prepare for war, and that Japan is its enemy; also to create implacable hostility to the United States by asserting that it aims to control or conquer Mexico.

The culmination of Germany's attempt to provoke war between the United States and Mexico is the following telegram sent by the German Foreign Office to Count von Bernstorff for transmission to the German Ambassador in Mexico, Heinrich von Eckhardt:

Berlin, January 19, 1917.

On the first of February we intend to begin submarine warfare unrestricted. In spite of this, it is our intention to endeavor to keep neutral the United States of America. If this attempt is not successful, we propose an alliance on the following basis with Mexico: That we shall make war together and together make peace. We shall give general financial support, and it is understood that Mexico is to reconquer the lost territory in New Mexico, Texas, and Arizona. The details are left to you for settlement. You are instructed to inform the President of Mexico of the above in the greatest confidence as soon as it is certain that there will be an outbreak of war with the United States, and suggest that the President of Mexico, on his own initiative, should communicate with Japan suggesting adherence at once to this plan; at the same time, offer to mediate between Germany and Japan.

Please call to the attention of the President of Mexico that the employment of ruthless submarine warfare now promises to compel England to make peace in a few months.

ZIMMERMANN.

Destruction of Ships and Their Cargoes

If strikes should fail to close American munition plants, if money were lacking to buy up all their products, and if the government refused an embargo, Germany's agents had yet another resource —to destroy war materials and other supplies for the Entente States while in course of shipment by sea. One project of this kind was carried out under the direction of Captain von Papen and Wolf von Igel. It consisted in placing in the holds of steamers incendiary bombs which, at a fixed time, would explode and ignite the surrounding cargo. The bomb shells were manufactured from designs by Dr. Walter T. Scheele, a German chemist of Hoboken, on the Friedrich der Grosse of the North German Lloyd line, and were then taken to Dr. Scheele's laboratory and filled with combustibles.

When the conspirators were tried, one of the witnesses called was a detective who belonged to the New York bomb squad and had worked on the case. Under the pretense that he was a German secret service man employed by Wolf von Igel, he had succeeded in making an appointment with Captain von Kleist, superintendent of Scheele's factory, and thus recounted the conversation with him:

We sat down and we spoke for about three hours. . . . I asked him the different things that he did, and said if he wanted an interview with Mr. von Igel, my boss, he would have to tell everything. So he told me that von Papen gave Dr. Scheele, the partner of von Kleist in this factory, a cheque for $10,000 to start this bomb factory. . . . He told me that he, Mr. von Kleist, and Dr. Scheele and a man by the name of Becker on the "Friedrich der Grosse," were making the bombs, and that Captain Wolpert, Captain Bode, and Captain Steinberg, had charge of putting these bombs on the ships; they put these bombs in cases and shipped them as merchandise on these steamers, and they would go away on the trip and the bombs would go off after the ship was out four or five days, causing a fire and causing the cargo to go up in flames. . . . He also told me that they have made quite a number of these bombs; that thirty of them were given to a party by the name of O'Leary, and that he took them down to New Orleans where he had charge of putting them on ships down there, this fellow O'Leary.

Between 300 and 400 bombs were manufactured, and fires were started by them on thirty-three ships sailing from New York alone.

Four of the bombs were found at Marseilles on a vessel which sailed from Brooklyn in May, 1915. The evidence collected in the case led to the indictment of the following men for feloniously transporting on the steamship Kirk Oswald a bomb or bombs filled with chemicals designed to cause incendiary fires: Rintelen, Wolpert, Bode, Schmidt, Becker, Garbade, Praedel, Paradies, von Kleist, Schimmel, Scheele, Steinberg, and others. The last three named fled from justice, Scheele being supplied with $1,000 for that purpose by Wolf von Igel. He eluded the Federal authorities until April, 1918, when he was found hiding in Cuba under the protection of German secret service agents. All the others except Schmidt were found guilty and sentenced, on February 5, 1918, to imprisonment for eighteen months and payment of a fine of $2,000 each. It was proved during the trial that Rintelen had hired Schimmel, a German lawyer, to see that bombs were placed on ships.

Schmidt, von Kleist, Becker, Garbade, Praedel and Paradies had already been tried for conspiracy to make bombs for concealment on ocean-going vessels with the purpose of setting the same on fire. All were found guilty, and on April 6, 1917, von Kleist and Schmidt were sentenced to two years' imprisonment and a fine of $5,000 each; the others to six months' imprisonment and a fine of $500 each. Wolpert and Bode, also indicted, obtained the privilege of a separate trial, which has not yet been held.

Robert Fay, a former officer in the German army, who came to the United States in April, 1915, endeavored to prevent the traffic in munitions by sinking the laden ships at sea. In recounting the circumstances of his arrival here to the chief of the United States Secret Service, Fay said:

. . . I had in the neighborhood $4,000. . . . This money came from a man who sent me over . . . (named) Jonnersen. The understanding was that it might be worth while to stop the shipment of artillery munitions from this country. . . I imagined Jonnersen to be in the (German) Secret Service.

After stating that he saw von Papen and Boy-Ed and that neither would have anything to do with him, apparently because suspicious of his identity, Fay continued:

I did not want to return (to Germany) without having carried out my intention, that it, the destruction of ships carrying munitions. I proceeded with my experiments and tried to get hold of as much explosive matter as in any way possible. . . .

Fay and two confederates were arrested in a lonely spot near Grantwood, New Jersey, while testing an explosive. During his examination at police headquarters in Weehawken immediately after the arrest he was questioned as follows:

Q—That large machine you have down stairs, what is that? A—That is a patent of mine. It is a new way of getting a time fuse. . . .

Q—Did you know where Scholz (Fay's brother-in-law) had this machine made? A—In different machine shops. . . .

Q—What material is it you wanted (from Daeche, an accomplice)? A—Trinitate of toluol (T. N. T.). . . .

Q—How much did the machinery cost? A—Roughly speaking, $150 or $200. . . .

Q—What would be the cost of making one and filling it with explosive? A—About $250 each. . . . If they had given me money enough I should simply have been able to block the shipping entirely.

Q—Do you mean you could have destroyed every ship that left the harbor by means of those bombs? A—I would have been able to stop so many that the authorities would not have dared (to send out any ships).

It was proved during Fay's trial that his bomb was a practical device and that its 40 pounds of explosive would sink any ship to which its was attached.

Fay and his accomplices, Scholz and Daeche, were convicted of conspiracy to attach explosive bombs to the rudders of vessels, with the intention of wrecking the same when at sea, and were sentenced on May 9, 1916, to terms of eight, four, and two years respectively in the Federal penitentiary at Atlanta. Dr. Herbert Kienzle and Max Breitung, who assisted Fay in procuring explosives, were indicted on the same charge, but have not been tried. Both are interned.

Another plan for disabling ships was suggested by a man who remained for some time unknown. He called one day at the German Military Information Bureau, maintained at 60 Wall Street by Captain von Papen, of the German Embassy, and there gave the following outline of his plan:

I intend to cause serious damage to vessels of the Allies leaving ports of the United States by placing bombs, which I am making myself, on board. These bombs resemble ordinary lumps of coal and I am planning to have them concealed in the coal to be laden on steamers of the Allies. I have already discussed this plan with . . . . at . . . . and he thinks favorably of my idea. I have been engaged on similar work in . . . after the outbreak of the war, together with Mr. von . . . .

The German secret service report from which the above exerpt is taken states that the maker of the bomb was paid by check No. 146 for $150 drawn on the Riggs National Bank of Washington. A photographic copy of this check shows that it was payable to Paul Koenig of the Hamburg-American Line and was signed by Captain von Papen. On the counterfoil is written this memorandum, "For F. J. Busse." Busse confessed later that he had discussed with Capt. von Papen at the German Club in New York City the plan of damaging the boilers of munition ships with bombs which resembled lumps of coal.

A similar scheme was conceived by Albert Kaltschmidt of Detroit, who hoped, however, not only to disable ships but to destroy them entirely. He hired Charles Respa, Richard Hermann, and a man known as "Frenchy," for $150 each to undertake this work. Provided with an ample supply of dynamite, painted to resemble coal, they went to New York City and tried by the use of a launch to approach coal barges and place the dynamite in the fuel intended for ocean going steamers. Guards were so vigilant, however, that nothing could be accomplished.

Germany's official representatives on the Pacific coast were engaged in similar enterprises. The leader was Franz Bopp, German Consul-General at San Francisco. His chief assistants were Baron Eckhardt von Schack, the vice-consul, Lieutenant Wilhelm von Brincken of the consulate, and Charles C. Crowley, a detective employed by Bopp as secret investigator.

Lewis J. Smith, a confederate, describes a part of their operations in a statement made to Federal officials. After he had told about his first meeting with Crowley, the United States Attorney asked him the following questions:

Q—When Crowley came to your house on Sunday (May 8, 1915) what was it he wanted? A—He asked me what I was doing. I told him that I had just left the Pinole Powder Works and was not doing anything at that time. He says, "Well, would you accept a job as watchman?" I looked at him for a second and says, "Watchman, what kind of a watchman?" "Well," he says, "kind of watching what is loaded on boats and so on." . . . I said, "What kind of a job is this?" "Well," he said, "there is some powder to leave here to-day or to-morrow, and we want you to leave here and be in Seattle." So I said, "What's in this job?" and he said, "Three hundred dollars a month and all expenses." So I said to myself, "I will try this." . . . . And Crowley paid me $250.

Smith went to Tacoma, and after his return to San Francisco had several conversations with Bopp, concerning which he testified as follows:

Q—What did he (Bopp) say he wanted you to do? A—He said it would be a matter of watching and spotting and if there was anything to blow up I was to help him.

Q—Bopp said that? A—Yes. . . .

Q—Well, then, Bopp told you that he wanted you to watch and also help blow up things? A—Whatever Crowley told me.

Q—Well, he mentioned blowing up things, did he? A—Yes.

Smith thus told about the payment which he and Crowley received for their services:

Q—How were you paid? A—Mr. Bopp paid.

Q—In currency? A—Yes; . . . and Crowley gave a receipt.

Q—Did you give a receipt? A—Yes.

Q—And was your receipt to Bopp? A—Yes.

Johannes H. van Koolbergen, born in Holland and naturalized in Canada, made a statement before British officials at San Francisco, concerning his relations with Consul-General Bopp. After describing a pretended attempt to blow up a tunnel on the Canadian-Pacific Railroad, van Koolbergen says that he was again summoned to meet von Brincken and that the following conversation occurred:

I went to the Palace Hotel in San Francisco. Von Brincken took me to his room . . . . and explained to me how an instrument could be made for the purpose of causing an explosion at the time set, and asked me if I was capable and willing to make such an Instrument, and asked me how much I would want for it. He explained to me that a club or association of fifteen Germans who all worked as longshoremen on the docks of San Francisco would have access to outgoing boats and could place one or more of these infernal machines on board boats of German enemies. . . .

The whole had to be small enough to go into a thermos bottle. The object of it being that a man at the harbor could carry a thermos bottle with him without being suspected of having anything injurious or dangerous with him.

Van Koolbergen then describes the making of a dummy bomb and proceeds thus:

I then went to see von Brincken in his room and showed him my work and he exclaimed that it was "famos." . . . Mr. Bopp (who saw it at the consulate) said that Mr. von Brincken was very satisfied with this machine and ordered the thermos bottle put in the safe, where I saw it yesterday, August 26, 1915.

Free access to Allied ships laden with supplies for Vladivostock would be invaluable to the conspirators, and in order to obtain it, Crowley resorted to the extraordinary scheme revealed in the following letter to Madam Bakhmeteff, wife of the Russian Ambassador to the United States:

Mme. J. Bakhmeteff, Care Imperial Russian Embassy, Newport, R.I.:

Dear Madam:—By direction of the Imperial Russian Consul General of San Francisco I beg to submit the following on behalf of several fruit growers of the State of California. As it is the wish of certain growers to contribute several tons of dried fruit to the Russian Red Cross they desire to have arrangements made to facilitate the transportation of this fruit from Tacoma, Washington, to Vladivostock, and we are advised that steamships are regularly plying between Tacoma and Vladivostock upon which government supplies are shipped and we would like to have arrangements made that these fruits as they might arrive would be regularly consigned to these steamers and forwarded. It would be necessary, therefore, that an understanding be had with the agents of these steamship lines at Tacoma that immediate shipments be made via whatever steamers might be sailing.

It is the desire of the donors that there be no delay in the shipments as delays would lessen the benefits to those for whom the fruit was provided. . . .

Respectfully yours,
C. C. CROWLEY.

The statements of Smith and van Koolbergen, combined with a mass of other evidence consisting in part of letters and telegrams, caused the Grand Jury to indict Consul-General Bopp, his staff and his hired agents for conspiracy to undertake a military enterprise against Canada. Among the purposes of this enterprise specified in the indictment was the following:

To blow up and destroy with their cargoes and crews any and all vessels belonging to Great Britain, France, Japan or Russia found within the limits of Canada, which were laden with horses, munitions of war, or articles of commerce in course of transportation to the above countries. . . .

In his charge to the jury the judge who presided at the trial reviewed the testimony given by the more important witnesses, among whom was Louis J. Smith. After describing how he was taken to Lieut. von Brincken by an employee of the German Consul-General, Smith testified:

Mr. von Brincken then asked me if I would take a job of following a barge of dynamite to Seattle, and exploding it in the harbor, to prevent it going on the boat. I told him I would.

Smith met Crowley the next day and the judge thus summarized Smith's testimony concerning their conversation:

Crowley (Smith says) told him that there would be other work, and wanted to know if he would put a few bombs on some of the ships up there; that quite a bit of ammunition was going to the Allies from Tacoma, and Smith told him he would. . . . He says that von Brincken came in a few minutes, and Crowley told him that he (Smith) was willing to take the job . . . and that von Brincken wanted to know if Smith would put bombs on boats as well as on the barge, and that he told von Brincken he would.

As the first ships marked for destruction sailed from Tacoma, Smith rented a house there with half cleared land attached, in order that he might have dynamite in his possession with the intended purpose of blowing up stumps. Crowley followed him to Tacoma within a day or two, and Smith's narrative of the events there is thus given in condensed form by the judge:

When the Talthybius (a British freighter) was ready to sail Smith says that he prepared the bomb made of 40 sticks of dynamite, put the sticks in the suit case. . . . He did not put dynamite either on the cars or on the boat, but told Crowley that he did.

At a later date, May 28 (1915), Crowley came and wanted another bomb prepared.

The Shinsei Maru was the ship which they looked for that Friday night, Crowley telling Smith that the bomb must be gotten off on the first string of cars off the wharf. . . . He says that Crowley left him and that after a time he drew the dynamite away; that he went to Crowley's hotel and deceived him in the belief that he had put a bomb on board the ship that night.

About the 29th of May, Saturday, Smith says they . . . (tried) to get a bomb into the cotton that the Hazel Dollar was loading and that he told Crowley that he had put the bomb in. Smith says he threw the dynamite away in a cesspool.

PULVERIZED FUEL COMBUSTION

By Frank C. Perkins.

THE use of pulverized coal is said to make practicable the highest efficiency obtainable in boiler operation. It makes coal burn like a gas, with a flame, the physical and chemical character of which is regulable—a flame that may be elongated or shortened, thus placing the zone of highest temperature where needed; a flame that may be made oxidizing, reducing or neutral, as occasion may require.

The coal is burned as pulverized, thus there is no storage of the powder with its attendant hazard. Artificial drying of the coal is not necessary if the supply be sheltered from rain and snow. Where the pulverizer is used, it is wholly a furnace question whether a dryer should be installed. It is not at all a pulverizing or storage question. The labor is reduced to a minimum and slack coal at low cost yields it last b.t.u.

The pulverizer described herewith approaches the subject of coal burning from the theoretical side, and, therefore, pulverizes the coal to an impalpable powder, and surrounds each of its minute particles with the amount of air which will furnish just the required oxygen. The fineness of the pulverization may be regulated by attention to the dampers which control the movement axially of the air within the machine. If that movement is slow, the centrifugal force keeps all coarse particles at the periphery, and they are drawn from one chamber to the next only as they become reduced to such fineness as to permit the axial current to overcome the centrifugal force, but if the movement axially is rapid, it in part overcomes centrifugal force and draws through the machine a coarser grade of material. The pulverizer utilizes air separation on thoroughly scientific lines. Powdered coal and air in regulable proportions are intimately mixed in the pulverizer, and the mixture reaches the furnace instantly it leaves the pulverizer.

The mixing operation commences at the feed end of the pulverizer, where coal and air enter together and the pulverizing and the mixing go on together until the mixture leaves the pulverizer having the appearance of a cloud of smoke. This impalpable powder, with its theoretical requirement of air, is conducted through a suitable pipe directly from the pulveriser to the furnace. There is no coal pulverized except for instant use. Every minute particle of coal is in the furnace and ablaze within one second from the time it leaves the pulverizer, and within one additional second is completely consumed. In a majority of cases the time is less than one-half a second in each case.

A condition is, therefore, created and maintained, in which each particle of coal is separated from every other particle when it enters the furnace, and no opportunity is offered for the powder to pack or for the particles to adhere one to another, but each particle is enveloped in air and, therefore, in contact with the oxygen necessary for combustion. Thus, this system is emancipated from not only the dryer, but the powdered coal conveyer apparatus, the storage bins, the mixing chambers and the feeding mechanisms with the power units required for the several operations. There is nothing between the coal bunker and the furnace except the pulverizer, its motor, and a plain pipe connection. When the mixture of coal and air reaches the furnace combustion proceeds with great rapidity, with no smoke, no carbon in the ash, no CO in the flue gases, and only a trace of O, and no appreciable excess air is admitted to reduce the temperature of the products of combustion.

There is no opening of doors, no intermittent firing, no banked fires, no delay in meeting a sudden overload. The pulverizer consists of three or more interiorly communicating chamber of successively increasing diameters, in which revolve paddles on arms of correspondingly increasing lengths. The separate chambers are, in fact, separate pulverizers on a single shaft, each succeeding pulverizer having greater diameter and, therefore, greater speed at its periphery and greater power for fine grinding, each receiving and treating the product of the preceding chamber and passing it on to the succeeding chamber for still further reduction.

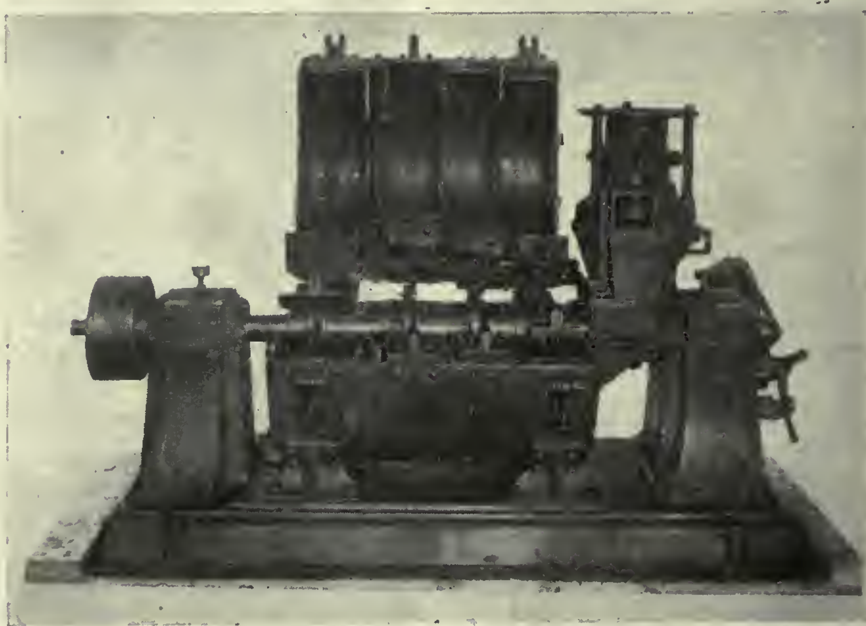
An additional chamber contains a fan, the function of which is to draw the finely pulverized material successively from one chamber to the next, and finally, to deliver it through a pipe connection to the furnace under the impetus of a forced draft. The separate pulverizers and fan are enclosed in one steel cylinder. A regulable feed mechanism accurately controls, and at the will of the operator varies the quantity of coal admitted to and delivered by the machine.

The feed mechanism is exact and uniform in its operation, and is easily adjusted to meet even minute variations in the fuel requirement. Two inlets in the feed mechanism admit the air required for fine grinding. An auxiliary inlet between the last work chamber and the fan, controlled by a damper, admits such additional air as is required for combustion. The air dampers with the feed mechanism give perfect regulation of the flame within a wide range.

Construction

The pulverizer runs at constant speed and the operator's attention and work is limited to observation of his fire and regulation of the feed mechanism. One operator can attend to a number of installations. The pulverizer is dust-proof, and is arranged for easy repair to the parts susceptible to wear, the cost of which is small. The paddles, which are subject to the greatest wear, are of cast manganese steel, heat-treated for ductility and to resist abrasion and are reversible. The shaft is of 40 carbon open hearth steel.

The spiders are in one piece, cut from ½-inch steel plate, and are bolted to cast iron hubs with shearing bolts of a size to withstand ordinary strain, but to shear with extraordinary and unusual strains. The linings are of steel plate, and there is a relief opening in the bottom of the first chamber for the automatic removal of any iron or other metal that may accidentally enter the machine.



COAL CRUSHER AND PULVERIZER.

This equipment may be located either in front of the furnace or at either side, or above or below, and may be set with the discharge opening toward the furnace or away from it, or in any intermediate position as convenience may dictate, and the drive may be by belt or by direct connected electric motor. The connection between the pulverizer and the furnace is usually a galvanized iron pipe from the pulverizer discharge to the furnace. No additional feeding or mixing apparatus could serve any useful purpose, for the powdered coal and air are intimately mixed in the pulverizer. The furnace end of the discharge pipe is made of such size and shape as the furnace condition requires.

Engineering at the Canadian Exhibition

Single Purpose and Standard Machines Are Shown — More Adequate Facilities Are Needed—Supply Houses and Transmission Specialists Also Have Interesting Exhibits on View

THE present trend of engineering manufacture is shown in the exhibits featured by the various manufacturers in Machinery Hall. Munition machinery, while still in evidence, is giving place to standard lines adapted to the more peaceful work expected as a result of after-war conditions. The exhibits compare favorably with those of former years, and granting more adequate facilities for exhibitors after the war, this portion of the exhibition should become one of the most interesting and attractive features on the grounds.

AS in past years the inadequate accommodation provided by machinery hall is very much in evidence, many exhibitors declaring their dissatisfaction with existing conditions and evincing a desire for better service and more room in which to display the various phases of mechanical industry. It is hardly just that the industrial arts, so all important in Canadian life and so essential to the successful prosecution of the war, should be limited by the accommodations provided while exhibits of a nature placing them in the non-essential category are given much more prominence in the many buildings of the Fair. It is hardly to be expected that any change for the better can take place until after peace is declared, but consideration should be given to the problem and the machinery exhibits given a location and buildings on the grounds where they would command the attention their importance deserves.

Cutting Tools

Recent progress in the field of cutting tools and metals is recorded in the display of Stellite by the Deloro Smelting and Refining Co. The makers of this well known cutting alloy have succeeded in perfecting methods by which formed tools of all shapes are readily cast and in such a manner that very little grinding or finishing is required. A display of welded cutters forms part of the exhibit, the cutters shown being stocking cutters used by the Hamilton

STELLITE FACED WELDED CUTTER BEFORE GRINDING

Gear Co. in operations on gear wheels. These welded cutters are formed of a soft steel centre on which the cutting edges of stellite are welded by the oxy-acetylene process. Built up cutters are also shown, the inserted blades of stellite being fastened to the steel centre by the usual methods. A recently discovered use for stellite is in the making of sand blast nozzles. These nozzles owing to the extreme hardness of the metal used usually last for about two weeks. This is an unusual length of time for nozzles of this purpose to last, the ordinary nozzle lasting for continuous work for about two hours.

Rough turning by the use of stellite is shown on an A. R. Williams Montreal lathe, six-inch shells being used. A Cisco lathe is also shown operating on cast iron.

The Cole Steam Trap

The effect of varying pressures and heads on the capacity of steam traps is clearly brought out by a working

COLE AUTOMATIC STEAM TRAP.

installation of the Cole automatic return trap. The trap used is of the high pressure type approved by the boiler inspection branch of the Department of Public Works; this trap is built to boiler specifications.

A typical double trap boiler feeding installation is also shown, draining both high and low pressure lines and returning the condensate from both as well as raw make-up water to the boiler. The balancing of return pressures by the use of high and low pressure traps is well shown by this exhibit. Cross-section models of the working parts of these traps are also on exhibit, one of which clearly shows the protector cage used on the steam valve, the disc being lifted into the protection afforded by a cage and removed from the paht of the steam, preventing its cutting by wire drawing.

Interesting literature is available at this booth dealing with various phases of power plant economy. Bulletin No. 7 treats of steam condensation, Bulletin 9 a reprint of an article appearing in *Power House*, by Wm. H. Rose, the representative, deals with the subject of automatic boiler feeding from the standpoint of economy compared to the use of feed pumps. Bulletin No. 11 is a publication of special interest to the plant or factory executive and treats of the steam plant as a factory which should be run on the same businesslike principles that govern factory management.

THE PNEUMATIC TOOL IN OPERATION.

Thor Pneumatic and Electric Tools

The Independent Pneumatic Tool Co., manufacturers of Thor tools, are represented by Mr. W. H. Rosevear, Canadian manager, and Mr. Gordon McCrea, Ontario manager. The various types of rivetting and chipping hammers and drills are shown in operation and an exhibit of the tools in sectional form shows the complete mechanism to advantage. The pneumatic drills are equipped with Corliss valves, roller bearings and pressed vanadium steel pistons and connecting rods. This latter construction results in very light yet strong working parts and removes much of the inertia load inseparable from reciprocating mechanisms.

Toledo Scales

Accuracy and dependability coupled with ease in manipulation mark the scales exhibited by the Toledo Scale Co., 335 Yonge St., Toronto, of whom C. H. Collins is the Canadian manager and W. E. Davies the Ontario special representative. The industrial scales manufactured by this company are on exhibit in machinery hall and the most interesting feature of the exhibit is the industrial 12,000-pound capacity, unit weight built in type dormant scale.

This scale has a large easily read dial graduated up to 2,000 pounds, and when heavier weights are to be weighed instead of adding weights to the beam by hand an automatic mechanism places the weights on the beam pan by the shifting of a lever. At the same time the weight in pounds which is to be added to the dial indications appears in large characters in a window on the dial face. This unit weight arrangement adds greatly to the sensitiveness of the scale, the dial indications reading to as small a figure for heavy loads as for small. Tare beams are also provided and if for any reason hand weighing is desired it is accomplished by unhooking the dial mechanism, placing a weight in an auxiliary scale pan and proceeding as usual in hand weighing.

The scale platform is not limited in size to any one set of fixed dimensions but may readily be adapted to any conditions likely to be encountered in practice. Industrial tracks may readily be used.

Baines and Peckover

The present developments in reinforced concrete construction for factory buildings and more especially the adaptation of this constructional material to the building of ships lend interest to the exhibit of concrete reinforcement featured by Baines and Peckover. A model of steps in concrete shows the steel reinforcement and the tie chain and bar ties to advantage. These steps also display to advantage another building material handled by this firm. Feralun anti-slip treads are incorporated in the steps and a Feralun plate and coal hole cover are shown at the bottom.

This product is formed by the integral incorporation of an abrasive substance into the iron body of the tread and the resulting surface prevents one of the most common causes of accidents, that of falling on stairs and the slipping on smooth cast iron surfaces. Steel-crete expanded metal machine guards are also featured, together with an excellent display of Triumph Suberb high speed tool steel, cold drawn and nickel steel bars.

S K F Ball Bearings

The Canadian S K F Co. of Toronto and Montreal, represented by Gordon Janes, H. N. Trumbull, A. G. Webster, H. Brown and Drummond Giles have an attractive display of S K F self-aligning ball-bearings and Hess-Bright ball and thrust bearings. Ball bearing hanger and bent shaft working models are seen in operation and loaded friction demonstration apparatus shows the comparative ease in operation of the ball-bearing over the ordinary journal. Numerous photographs, display literature, showing applications of ball-bearings, and the display of "Atlas" chrome alloy steel balls in various stages of manufacture form interesting features of the exhibit.

Boiler Protector Co.

The National Boiler Protector Company, 24 Lombard Building, have an exhibit showing their girth seam patch and blow-off pipe protectors, together with short elbows and long sleeves which go with the blow-off pipe protector. The exhibit consists of a complete girth seam protector attached to boiler plate and a complete blow-off pipe protector together with the separate units that go to make up the two items.

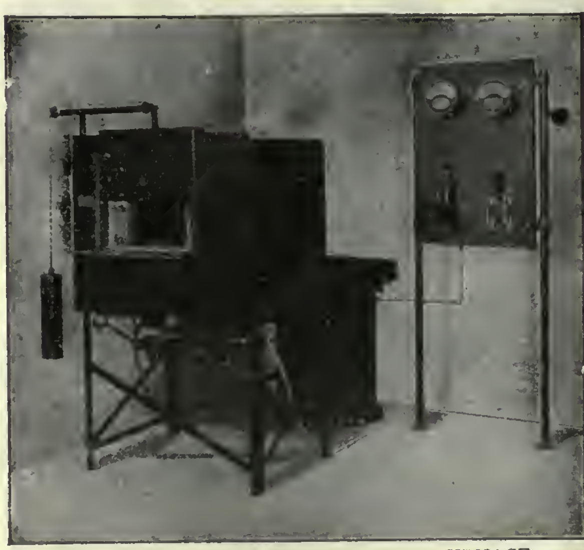
Oil Burners

The National Oil Burners and Systems Limited, Lombard Building, have a display of oil burners adaptable to high and low pressure boilers. These oil burners have been tried out for the last nine months and have given extremely good satisfaction on both boilers for the generation of steam and on metallurgical work such as case hardening furnaces, heat treating furnaces, and forging furnaces.

Hoskins Electric Furnaces

The increasing appreciation of the benefits of heat treatment and accurate temperature control is reflected in the exhibit of Hiram Walker and Sons, Walkerville, who are handling the well-known Hoskins line of electric and gas furnaces, pyrometers, pyrometer couples and laboratory apparatus. Their product also includes a unique product, Nichroloy, a non-ferrous alloy which possesses marked non-corrosive properties, especially under the influence of heat. These properties are due to the high melting point of chromium combined with the high resistance of nickel to oxidation. This metal does not soften appreciably under heat as does cast iron and has a life approximately 40 times as long. Applications already proven include carbonizing boxes, cyanide crucibles, lead pots, barium pots, etc.

It is of especial interest to know that this alloy is made in Canada, together with a special type of carbon resistance furnace which is also displayed. Its simplicity of construction and efficiency of operation render it particularly adapted to high temperature work.



HOSKIN ELECTRIC RESISTANCE FURNACE FOR THE HEAT TREATING OF STEEL

HAMMER IN OPERATION. CLEAVELAND CHIPPING

Pratt and Whitney

Special appeal is made to the skilled mechanic and fine tool maker by the Pratt & Whitney exhibit of Canadian-made cutters, reamers, taps, drills, shell tools and special articles of a similar nature. The prestige attached to the name is well upheld by this exhibit, which is convincing evidence of the possibility of producing such goods on a commercial scale within the Dominion.

Transmission Equipment

Transmission equipment and apparatus is featured by the Dodge line, one of the items of interest being an exhibit showing their wood pulley in different stages of construction; from the plain board of selected lumber to the perfectly finished wood-split pulley seen on the shafting.

Pneumatic Tools

The Cleveland Pneumatic Tool Co. of Canada, Ltd., are showing a complete line of pneumatic tools and appliances such as are used extensively in the shipyards of Canada and the United States. The new pocket in head riveting hammer shown by this firm has an improved valve arrangement which adds greatly to the effectiveness of the hammer and the pocket in head construction forms a reservoir for compressed air which increases the force of the blow. A line of compressed air drills, accessories and hose is also shown.

The Perfect Machinery Co.

The Perfect Machinery Co., Galt, have a display of gear-driven and sensitive drills, a full line of grinders equipped with both machine guards and exhaust hoods. Three types of hacksaws for various purposes are shown and an 18 inch double back geared quick change gear are shown. 12-inch and 14-inch lathes suitable for garage or engine work are also shown. These lathes are an example of accurate high grade workmanship and convenient design. It is a very convenient tool for machine shops, experimental shops, trade schools and manufacturing opticians. These lathes are made with 12 and 14-inch swing and a 6-foot bed.

Garlock-Walker Machinery Co.

The Garlock-Walker Co. have a representative display of woodworking and machine tools, band saws, surfacer saw filing machine, cutting off saws forming part of the exhibit. A Lodge and Shipley 20-inch selective head engine lathe is shown in operation. This lathe has been designed for quantity production and the mechanical arrangement of the operating details leave little to be desired in the way of ease in operation. A Leisy-Patton threading and screw machine is also shown.

Electric Motors

Jones and Moore have a representative display of their various motors and generators and of the American shoe machine for which they are the agents. This firm handles a large stock of Century motors for all conditions of service.

Belting

The Main Belting Co. of Canada, S. R. Walsh representative, have a display of Leviathan and Anaconda belts adapted both for power transmission and conveyor purposes. These belts are specially impregnated when required to handle extremely hot or abrasive materials and in combination with the conveyor rolls manufactured by the same firm give excellent service under severe conditions. A sample of belting taken from a belt 80 inches wide and of 300 feet run forms an interesting part of the exhibit. Belt fastenings, dressings and other materials used in the transmission of power are also shown.

L'AIR LIQUIDE SOCIETY

A standard line of oxy-acetylene welding and cutting apparatus is being shown by L'air Liquide Society. Examples are shown of manufactured articles fabricated by the welding process, among which are sheet steel welded transformer cases by the Packard Electric Co., bread racks by the Brantford Oven and Rack Co., steel furniture by the Office Specialty Co. and high pressure boiler by Damp Bros.

The manufacture of welded acetylene cylinders is being carried on and the welding demonstration of the soldiers' Civil Re-establishment exhibition is using apparatus of this company's make. A school for the instruction of the returned soldier in the art of welding and cutting metals is being carried on at the company's plant, the soldier being given a six months' course at the expense of the company for the materials used and the instruction given.

Canada Machinery Corporation

A fine exhibit of iron and wood-working tools is being shown by the Canada Machinery Corporation, a 26 in. 12 ft. bed heavy duty lathe with quick change gears is exhibited and a recent design is seen in a 20 in. crank shaper with power down feed to head. The drill presses comprise 20 in. back geared press and plain lever drill presses.

In the wood-working machinery branch are seen the new straight edging and jointing saw; a new tool on the Canadian market and which is being operated; a variety saw with band and a 6 in. four-sided sticker. This exhibit of made in Canada machinery is under the charge of Mr. King, who has the assistance of P. D. Burton, assisted by Mr. Preston and H. O'Donnel.

Canadian Ice Machine Co.

The Canadian Ice Machine Co. have an excellent exhibit of refrigerating supplies and materials; fittings, ammonia, calcium, chloride and other supplies being featured. This firm are the manufacturers of the York refrigerating systems and compressors, installations being made from ¼ ton up in the direct expansion, absorption or CO_2 systems, the latter being popular and of considerable adaptability for hospital and marine work.

The Carter Welding Co.

The Carter Welding Co. are showing the Beck-Todd spacing machine, a Canadian invention used for the elimination of recuts in nicking shell steel. This machine, by a suitable mechanism, divides the bar steel into a desired number of pieces, all of equal length, no matter what the length of the steel bar may be. By achieving this result no recutting of the last billet is necessary to eliminate a short end. This machine finds its greatest application in the nicking of shell steel by the oxy-acetylene torch.

The oxygraph is shown in operation cutting test pieces out of 6 in. shell billets at a time rate of about two minutes per test piece, the cost of the operation being about seven cents.

High pressure acetylene generators are on exhibition, acetylene being generated at from 50 to 200 lbs. pressure as may be desired. In addition to a complete line of Davis-Bournonville cutting and welding torches a standard government emergency outfit is shown. This outfit of cutting and welding torches is enclosed in a bullet deflecting case and large numbers are being used with the American army in France.

A water-cooled torch for heavy work is shown, the tip being water jacketed.

Belt Dressing

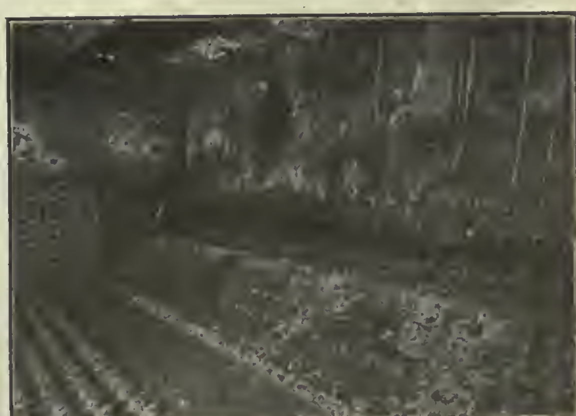
The present exhibition marks the tenth year for the Cling Surface Co. at Machinery Hall. The saving in power produced by this belt dressing and the longer life of the treated belt are of particular importance at the present time in view of the wide-spread necessity for the economical use of power. Aside from the economy effected in power the preservation and water-proofing of the belts, the saving in lacing and the lowering of the friction load consequent upon the permissible slackness of the belts are desirable features. The belt driving the lathe demonstrating Stellite has been treated with Cling-Surface. Mr. J. B. Faatz is the representative of the Cling Surface Co.

Mechanical Rubber Goods

The Dunlop Tire and Rubber Co. are exhibiting their mechanical rubber goods for the first time in Machinery Hall, Mr. H. C. Austen being the representative in charge. Engineers' supplies and rubber belting are featured.

A large demand has been created for Gibraltar Red friction covered belt, consequent upon the expansion of the munitions business. This belt is made of heavy canvas duck impregnated with a very strong friction. Valve discs hose for industrial purposes and the Gibraltar Red pneumatic tool hose, made to meet the demands of the shipbuilding industry, comprise a portion of the exhibit.

BOILER PREPARED FOR WELDING



BOILER AFTER WELD IS COMPLETED.

A. R. Williams Co.

The A. R. Williams Co. have an excellent exhibit of iron and woodworking tools. A variety of drill presses including bench drills is shown and A. R. Williams, Montreal lathes, and a Cisco lathe are being used to demonstrate the use of Stellite in the exhibit of the Deloro Smelting and Refining Co.

Marine interests are well represented in a line of marine gas and pumping engines and the wood working tools shown are particularly applicable to the needs of the marine industry. A 36 in. Preston bandsaw and 24 in. Eclipse planer are on exhibit together with a variety of tilting saw tables and a self feed ripsaw made by the Preston Machinery Co. The needs of the manual training schools for instruction lathes are met by a lathe also by the above firm with an attached motor. A Preston two-spindle shaper is shown which is self contained, the double countershaft and motor being installed in the base of the machine.

In the metal working department a universal Le Blond milling machine is shown and a demonstration is being given of the Racine metal-cutting saw; this machcine owing its excellent cutting abilities and economical use of saws to the arrangement whereby the saw is raised from the work during the return stroke. The excellent exhibit is under the care of Mr. Cronk and the arrangement is due to him. In connection with the A. R. Williams' exhibit a demonstration of the tungsten spark plug is arranged, the wearing qualities of the plug being due to the extremely hard and refractory material of which the points are made.

Canadian Consolidated Rubber Co.

One of the most interesting industrial processes is the turning of crude rubber received from the plantations and forests into the manifold articles met with in daily life and anything showing the various forms rubber assumes during its progress step by step through the factory is unusually interesting to anyone. The Canadian Consolidated Rubber Co. are showing an exhibit of this kind in the process building, each form assumed by the rubber being shown from the wild and plantation rubbers to the finished article.

This company are also showing an excellent exhibit of their mechanical rubber goods, featuring their engineers' supplies and belts. The Dominion belt shown is a belt made with extra strong friction and is designed for severe service both in the transmission of power and in conveying operations.

The Chapman Double Ball Bearing Co.

This company has, as usual, a most attractive exhibit of the various lines manufactured by them in the center row at Machinery Hall.

In addition to their ball-bearing shaft hangers used in the line shafting the exhibit includes bearings for all sizes of shafting up to six inches; also annular and thrust bearings for machinery, automobiles and trucks. This latter line is a new development for the company and supplies the Canadian market with a made-in-Canada product.

The various products are artistically arranged on pillars mounted on large turn table ball bearings which have been manufactured for the Grand Trunk Railway and as an illustration of the extremely light friction load of the ball bearings the turn tables and a length of ball bearing equipped shafting are turned by means of a fractional horsepower motor through thread belting.

The excellent qualities of these bearings has enabled the company to enter the export field and the United States market is supplied by their Buffalo plant.

Several sizes of the Universal truck for industrial and shop use are also shown.

Prest-O-Lite Co.

The many uses to which oxy-acetylene welding is put are well illustrated in the many types of apparatus shown in the Prest-O-Lite display. The exhibit comprises all their various welding and cutting torches, including a small instrument for jewellers' and dentists' use.

PREST-O-LITE EQUIPMENT BEING USED IN WELDING OPERATION.

Particular attention is drawn to the use of dissolved acetylene for welding purposes and the convenience of this apparatus for lighting large areas where construction work is being carried on is especially commended.

D. K. McLaren, Limited

This company represented by Mr. W. S. Hamilton, sales manager, are exhibiting their line of single and double leather beltings, together with the waterproof varieties. Canvas balata impregnated belting is also shown. D. K. Wood split pulleys, which are shown in various sizes, are constructed of carefully selected materials, air dried for months and kiln dried before being made up. The spokes are built up of white oak carefully secured into the rim.

The Philips pressed steel split pulley, for which this firm are the sole Canadian selling agents, is another line which has met with a wide sale. The hub is made of cast iron, bored to a perfect fit and is clamped by four hub bolts. The spider is heavy sheet steel and is riveted to the hub. The rim formed from sheet steel is flanged in on both edges the sheet extending back to the center where it is bent at right angles and forms a central rib to which the spider is riveted.

An interesting set of photographs of a leather belt recently completed for main drive purposes is on view. This belt is unusual in that it is made of four plies, the dimensions of the belt being 110 ft. x 24 in. width. The belt is waterproofed.

Mill supplies for the carding, spinning, weaving and hosiery trades are also featured.

Dodge Manufacturing Co.

This company have an excellent display of standard transmission machinery exhibiting their shaft hangers, conveying apparatus, wood and iron split pulleys. The various steps in the manufacture of the wood split pulley are shown. The method of jointing segments by means of dove-tailed glued joints, the building up of the laminations into the completed rim and the method of attaching the pulley arms to the rim being clearly shown. The construction adopted permits the turning of the inside of the rim. The rim is finished with a special filler and varnish which secure a very durable surface and one which reduces belt slip to a minimum.

The West Toronto Foundry

Eclipse shaking and dumping grater are being shown by this firm in Machinery Hall, the ease of operation and the fuel economy resulting from their use being especially commendable.

The Mac 8 syphon for isolated sewage disposal plants is another product shown that finds a particular application on farms or other places where septic tanks are installed. No moving parts are used, the intermittent action of the syphon depending on an air seal.

Thomas J. Brown has been reappointed to his former position as general superintendent of the Sydney Mines of the Nova Scotia Steel and Coal Co. This appointment was one of the first official acts of D. H. McDougall as president of the Nova Scotia Steel and Coal Co. His new duties will involve the management of the steel plant in addition to both collieries. It is understood that Thomas H. Hartigan will also resume his former position at the Scotia works as assistant to Mr. Brown.

Representation of Screw Threads and Dimensioning

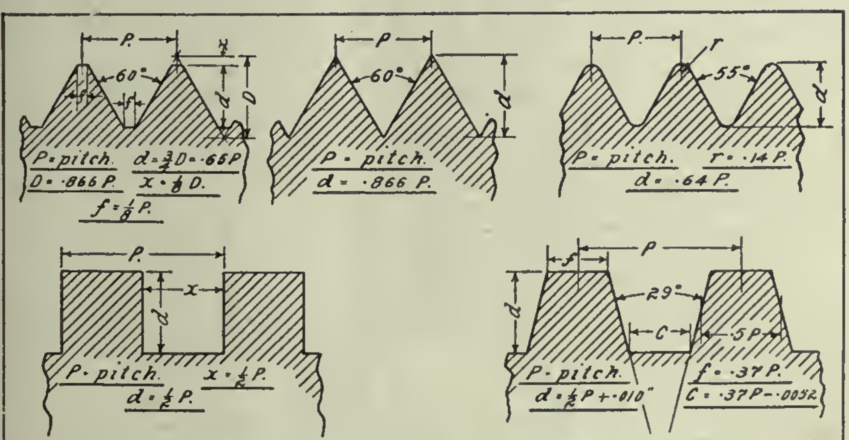
Proper Delineation of Screw Threads is an Important Detail in Connection With Mechanical Drawing, and Accurate Dimensions Are Very Essential

REPRESENTATION of screw threads in mechanical drawings is a subject worthy of rather detailed consideration. It is seldom that a mechanical drawing does not show thread of some sort or other. If a man who makes many drawings would reckon the number of screw threads which he renders in a year, he would find the value much greater than would be anticipated. It is, therefore, extremely desirable, both from the standpoint of good economics and good appearance, to learn at the start the best methods of showing screw threads on drawings.

The applications of the screw threads of the different types will not be considered in detail herein. That is, it is not proposed to discuss exhaustively the relative merits of the threads of the different designs. Treatises on machine design cover this subject. It will be assumed that the reader understands something of the applications of the different threads. Hence, in the following discussion, the methods of delineating will be given primary consideration.

Screw Thread Forms

The different forms of screw threads which are in common use are shown in Figs. 1 to 5 inclusive. Fig. 6 defines graphically the names of the parts of a thread. The pitch, P ((Fig. 6), is equal to 1 ÷ (number of threads per inch). For example, a 1-2 pitch on a screw means that it has 12 threads per inch. The ¼ pitch shown in Fig. 6 means that that screw has four threads per inch. Some of the important pictorial characteristics of the screw threads of the different types will be discussed in sections which follow.



FIGS. 1-5—FORMS OF THREADS IN GENERAL USE.

The United States standard thread (Fig. 1) is the one which is used much more frequently than any of the others and is, so it is ordinarily understood, the type to be used unless some other is definitely specified. This form is also known as the Franklin Institute standard and the Sellers standard. As detailed in Fig. 1, the sides of the groove cut from the material to form the thread are inclined to one another at an angle of 60 degrees. The crest of the thread is cut off for a distance equal to one-eighth of the height and the bottom or root is filled in for this distance. This flattening of the crest and root increases the strength of the thread and renders it less likely to become mutilated by rough treatment. While a true U. S. standard thread is actually turned with a flattened crest and root as shown in Fig. 1, these flat surfaces are seldom if ever shown on mechanical drawings.

The "Sharp" V thread is detailed in Fig. 2. The only difference between this and the U. S. standard is that the crest and root are not flattened. In spite of the fact that the U. S. standard is the better type from every standpoint, the "sharp" V thread is utilized frequently, although it is probable that its applications are continually decreasing in number.

The Square thread (Fig. 3) has all of its faces at right angles to one another. This type of threads finds its principal application in the transmission of motion or force for which purposes it is better adapted than are the V threads. Examples of applications of the square thread may be found on the feed screws of metal turning lathes and on the screw of an ordinary letter press. The "Acme" thread (Fig. 4) and the "Whitworth" thread (Fig. 5) are used occasionally.

Briggs pipe threads (Fig. 7) are standard in this country for threading the ends of pipes which screw into tapped holes or couplings. These threads may be represented by the conventional method detailed in Fig. 7 at I. Note that the parallel lines representing the crest and the root of the threads are not inclined at an angle but are horizontal. Also note that each line does *not* extend entirely across the pipe. On large drawings or where for some reason the time

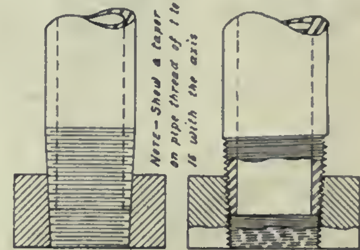


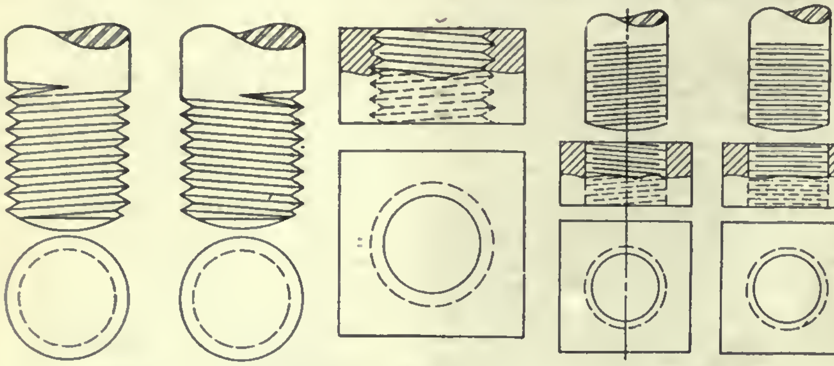
FIG. 7—PIPE THREAD.

expenditure involved is justified Briggs pipe threads can be rendered as at II. in Fig. 7. It is seldom, however, that such a detailed picture is necessary on a mechanical drawing. It should be noted particularly that the pipe thread tapers so that as the thread is screwed into a coupling or tapped hole it wedges itself tightly. This taper should be shown on the drawing if it is large enough to warrant it.

Right-hand threads and left-hand threads differ from one another in that an object which is threaded with a right-hand thread moves longitudinally away from the person who is turning it when it is turned in the direction in which the hands of a clock rotate; that is, in a clockwise direction. A left-hand thread moves away when it is turned in a counterclockwise direction. The applications of left-hand threads are relatively very few. Where they occur on a drawing they should be marked distinctly LH, and the rendering of the thread should also, in accordance with one of the methods to be described, be such that it will indicate that it is a left-hand thread. Note that the lines representing a right-hand thread (assuming that the threaded rod lies in a vertical position) slope up from left to right as shown in Fig. 8, while the lines of a left-hand thread (Fig. 9) slope in the opposite direction.

Thread Representation

The methods of representing V threads will now be considered. When the diameter of a bolt or the diameter of the hole in a nut, as it is plotted on the sheet, scales more than 1 inch, the methods illustrated in Figs. 8 and 10 may be employed on drawings where attractive appearance is an important factor. Where the diameter (as it scales on the sheet) is less than 1 inch and greater than 3/16 inch, the method of Fig. 11 or 12 is employed. In fact, these methods (Figs. 11 and 12) are ordinarily used on shop drawings even where the diameter of the threaded part scales greater than 1 inch. The difference between the rendering of Figs. 11 and 12 is that in Fig. 11 the thread lines are inclined, while in Fig. 12 they are horizontal. Where threaded objects, which scale less than 3/16 inch in diameter on the sheet, are to be shown, the delineation suggested in Fig. 13 may be utilized. With this method, the thread lines do not extend entirely across the width of the object. A threaded rod with a tapped hole in its end can often be shown effectively in section, as detailed in Fig. 14.


FIGS. 8-12--CONVENTIONAL METHODS OF SHOWING THEADS.

The double thread is one which is really a combination of two threads on one screw (Fig. 15). A double-threaded bolt advances twice as far per revolution as does a similar single-threaded bolt. See also Fig. 22 for a double right-hand square thread.

In drawing pictures of V threads like that of Fig. 8 for example, there is a certain procedure (Fig. 16) which should be followed. At A is represented the first step. Note that the measurements for the thread lines are made only along one side of the rectangle upon which the thread lines are to be shown. Then by sliding a triangle along a straight-edge which has been sloped slightly, the parallel lines representing the thread crests can be drawn. The slope, as shown at A, of each crest line equals ½ of the pitch for a single thread. The next step is (B) to draw lines of 60 degrees in one direction from the end of each of the thread crest lines. Next, as at C, a 60-degree line is drawn in the other direction from the end of each thread crest line. Then to complete the screw, the lines representing the roots of the threads are drawn in.

The representation of square threads will now be considered. The actual appearance of the square thread bolt and nut is that given in Figs. 17 and 18. Two helices, one representing the outside face edge and the other the root of the thread, are required in this pictorial representation if it is to be rendered accurately. However, it is seldom that such procedure is desirable as the conventional rendering of Figs. 19 and 20 conveys the idea adequately. A left hand square thread can be rendered as diagrammed in Fig. 21 and double and triple right-hand square threads as in Figs. 22 and 23 respectively.

The representation of the Acme thread is given in detail in Fig. 24. A comparison of this with the data given in Fig. 4 will indicate why the representation of Fig. 24 is desirable. It is to be understood that the nut of Fig. 24 is threaded for part of its length for a right-hand thread and for the remainder of its length for a left-hand thread.

Importance of Dimensions

The dimensions are probably the most important element of a working drawing because without them the sheet would, obviously, be useless. A roughly-executed sketch, if properly dimensioned, will convey its story effectively. But if the most deftly-executed drawing is improperly dimensioned, it will be worthless and may make no end of trouble.

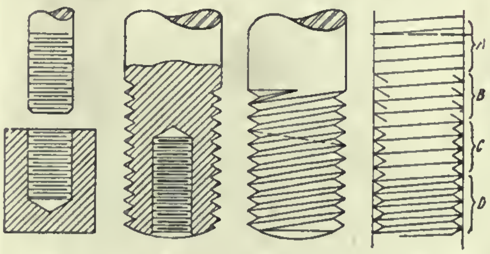


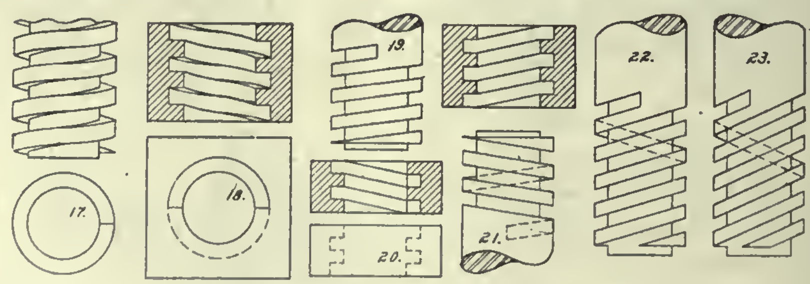
FIG. 13. FIG. 14. FIG. 15. FIG. 16.
CONVENTIONAL METHOD OF ILLUSTRATING THREADS.

As used here, the term "dimension" comprehends not only the digits or figures indicating inches or other units of measurement, but also the arrow-heads (sometimes called barbs), the lines in which the dimensions are inserted and also frequently some notation. By notation is meant any symbol or sign which may be required to denote certain quantities. Examples of such symbols are: ′ (ft. or min.), ″ (in. or sec.), ° (deg.), etc., etc. Dimensions should be so placed that there can be no confusion in interpreting their meanings. Unfortunately this obvious rule is often violated. It is imperative that the figures be of such size and so located that they can be easily read. The arrow heads should be carefully placed so that there can be no mistake as to the extent of the dimension. Furthermore, the outline of the drawing should not be "marred" by any dimension. That is, no figure should touch or intersect the outline of the object. The dimension lines should be light so that there will be great contrast between the outline and the dimension lines, the outline lines being much more prominent. In general, it is desirable where possible to place the dimensions outside of the views. Opinion differs as to the most desirable form of arrowhead. The long slim form shown in Fig. 25 is preferred by some draftsmen and is probably as good as any, although a number of organizations insist on the use of an arrow-head which is "short and fat" resembling the Roman letter V.

Good and bad practice in dimensioning are pictured graphically in Figs. 25 and 26. From a superficial examination it is apparent that the drawing of Fig. 26 is much easier to "read" than is that of Fig. 25, although both of them show the same object and the same dimensions. "The List of Errors" given under Fig. 25 recites the features in which that illustration is incorrect. The number preceding each item in the list corresponds to an identification number located within a circle in Fig. 25.

Rules which should be observed in dimensioning drawings are given in the following list. While this is not complete, it certainly includes the more important cautions.

1. The dimension should represent the finished size of the piece.
2. The dimension should be written so as to be read from the bottom or right side of the sheet. Some drafting rooms follow the practice of writing all dimensions horizontally.
3. The figures of a dimension should when convenient be placed in a space near the centre of the dimension line.
4. The figures should be placed so that the line, if extended, would pass through the centre of them.
5. Fractions are to be made with a horizontal line between numerator and denominator. This division mark is to be made free-hand. The fraction should be about one and one-half times as high as the whole numbers, as shown in the example of Fig. 27a.
6. In general, give dimensions in



FIGS. 17-23—REPRESENTATION OF SQUARE THREADS.

inches up to 2 feet—over 2 feet, write 2 ft. 3" or 2' 3". The form 2 ft. 3" is the surest method and is to be recommended. 36-½ in. should be written 3 ft. ½".

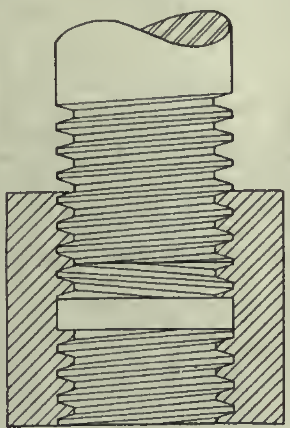


FIG. 24—THE ACME THREAD.

7. Make figures large enough to be read easily—distinctly plain and open.

8. The extension lines between which the dimension is placed should be a light line extending from corners, etc., between which the distance is desired. The extension line should not touch the object being dimensioned—leave space of 1/32" as in Fig. 27b.

9. A series of dimensions should be given in a straight line—not staggered. (See Fig. 27c and d respectively.)

10. With each series of dimensions, especially if they altogether total to the size of object, there should be given a corresponding over-all dimension.

11. It is well where possible to place dimensions between views. They are easily found there.

12. It is bad policy to repeat a dimension in two or more views; it might sometime be changed in one view and neglected in others.

13. When a circle is complete, the diameter is the better dimension to give. Radii should be given only for arcs.

14. When the diameter of a circle is given across the circle, the dimension line must pass through the centre of the circle.

15. The dimension of the radius of an arc must have the dimension line extending toward the pivot centre of the arc. (Fig. 27e, f, and g).

16. The arrow-head is on the end touching the curve—never on each end of the radius.

17. When a circular view is omitted, the diameter should be accompanied by "Dia." or "D". (Fig. 27h and i).

18. Never allow a dimension line to extend along a centre line.

19. Never allow a figure of the dimension to touch a line of the drawing.

20. Do not place a dimension on cross-hatching unless necessary. If necessary leave cross-hatching out around the figures. (Fig. 27j).

21. Dimensions should not be given between invisible outlines, since these lines are usually uncertain.

22. Do not crowd dimensions—they become confusing.

23. Never show a finished surface located from a rough cast surface.

24. In contemplated objects it is often advisable to give dimensions from centre lines.

25. Select dimensions so that the shop man will not have to add or subtract. He may make a mistake.

26. If it is possible to locate a required point from two finished surfaces, or centre lines, do so in preference to giving an angular dimension.

27. If too little room is allowed between extension lines for arrow-heads and figures, the arrow-heads should be placed on the outside of the extension line, or the figures may be placed outside.

28. All dimensions should be placed where they may be quickly and readily found.

29. The figures should be placed where they may be easily erased without disturbing the other lines of the drawing or where they may be duplicated with correction. (Fig. 27k).

30. Usually the scale of the drawing should be placed on the sheet.

31. Where very close work is required, the values of the limit dimensions should be decimals indicating the exact dimension or limits between which the work must caliper. (Fig. 271, n and m). (Refer to Sect. following on limits).

32. When a dimension is indicated by a leader, usually the leader ends with a half-arrow. The leader should be made mechanically, barb free-hand. (Fig. 27o and p).

33. The leader should be drawn in such a direction that the dimension or note may be horizontal or vertical, never oblique. (Fig. 27q and r).

34. The figures and notes should be kept uniform in size. ⅛-inch high is good height for ordinary work for the digits.

35. Figures along a diameter or radius change direction on a line sloping 60 deg. to the left through the centre of the circle. (Fig. 27s).

36. Never write figures, print them.

37. When there is a group of dimensions the shortest should be inside, longest outside. (Fig. 27t).

38. Check over-all dimensions by computation as well as by scaling.

39. When dimensioning a tapered object give taper per foot of length.

40. When threaded pieces and tapped holes are dimensioned by giving the diameter, the dimensions may be given by giving the diameter and the number of threads per inch. (Fig. 27u and v).

Limits and Tolerance

The specification of limits becomes of great importance on modern mechanical drawings of parts. Frequently the

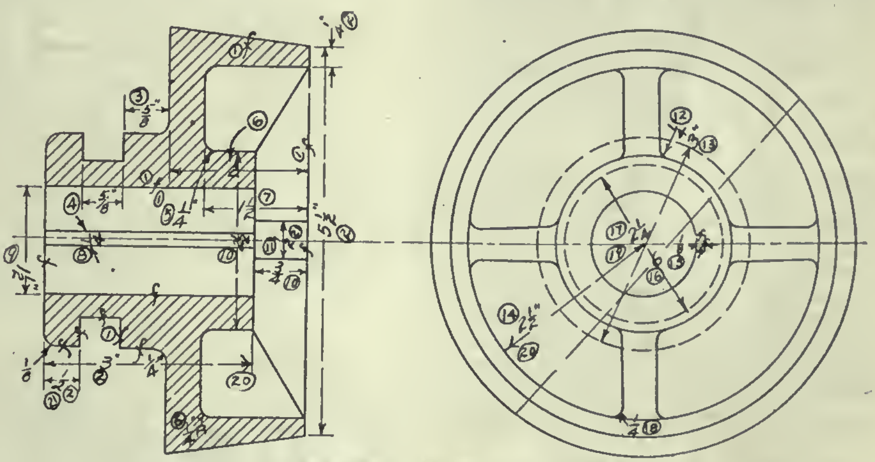


FIG. 25—INCORRECT METHOD OF DIMENSIONING.

LIST OF ERRORS IN DIMENSIONING FIG. 25.

1—Cross on "f" should be outside.
2—Extension line should not cross dimension line (Rule 37).
3—Measurement should not be taken from rough cast surface (Rule 23) and dimension too low (Rule 4).
4—Horizontal line should be between 5 and 8 (Rule 5).
5—End leader with half arrow (Rule 32). It would look better to extend in opposite direction.
6—Dimension should not be on cross hatching (Rule 20).
7—Awkward location.
8—Dimension line should be at right angles to boundaries under consideration.
9—Figures face wrong direction (Rule 2).
10—Figures crowded and touching outline (Rules 19 and 29).
11—Bad judgment in placing dimension. Should be on other view.
12—Radius line should point toward center (Rule 15).
13—Figure in poor location. Better near center (Rule 3). Dimension uncertain (Rule 21).
14—Dimension too high. Dimension line should be in line with center of fraction (Rule 4). Should be diameter (Rule 13).
15—Dimension line should not extend along center line (Rule 18).
16—Dimension line should pass through center of circle (Rule 14) and dimension misleading.
17—Figures should read with center line (Rules 4 and 35). Dimension uncertain (Rule 21).
18—Bad. Figures should not touch any line (Rule 19).
19—Arrow-head should be omitted (Rule 16).
20—Arrow-heads spread too much.
21—Written figures do not look well (Rule 36).

exact size of the parts which should fit together is not considered by the draftsman. For example, if a pulley is to run idle on a shaft, the diameter of the shaft may be specified as 1¼" and the hole in the pulley also as 1-¼". It is obvious, however, that if both the hole and the shaft are exactly 1-¼" the one cannot fit into the other, much less rotate on it without excessive friction. In fact, there should be a clearance of about 0.002" to insure satisfactory operation. Again, if a gear is to be fitted on to a shaft permanently, it may be desirable to have a "force fit." That is, it may be desirable to force the gear on to the shaft which is to carry it with a hydraulic press. If such is the case, the shaft should be at least 0.0005" larger than the hole.

Many concerns have standardized "limit" requirements which are always followed for their drawings and construction. Other concerns do not specify limits. Since, however, it is a fact that quantity production work cannot be absolutely exact as to dimension and that the different shop men have different opinions, it is certainly better to specify different limits or give "tolerances" for dimensions of parts that fit together. This is particularly true of important parts.

For example, for a running fit the shaft diameter should be a certain amount smaller than the hole diameter. Thus the shaft diameter dimension may read $\frac{1.2475''}{1.2485''}$. This means that the diameter of the shaft when measured with micrometer calipers must lie between these limits. Again for a "force fit" the shaft should be larger than the hole. Hence, for a force lift the limits for the diameter of the shaft might be $\frac{1.2505''}{1.2510''}$. It is assumed that the hole is to be reamed standard size—exactly 1-¼".

Another method of writing limits is to specify the permissible variation. On this basis the limits for $\frac{1.2475}{1.2485}$ might be written 1.2480" ± .0005", or 1.2480" $\begin{matrix}+.0005'' \\ —.0005''\end{matrix}$. If it is understood that the permissible variation was 0.0005", then 1.248" ∓ might be a sufficient specification. Sometimes it might be desirable that the dimension of a finished piece be greater rather than less than the dimension specified on the drawing. Such a preference might be expressed by 1-¼+ or vice versa 1-¼—.

It is always desirable that the limits be specified in the drafting room rather than to leave these things to the man in the shop. If limits are not specified on the drawing the shop man must, before he can proceed, have a knowledge of how the parts assemble. To acquire this knowledge may involve an expenditure of time which could, partially at any rate, have been saved if the limits were originally specified in the drawing room. Furthermore, the draftsman has for consultation his handbooks, references and standard specifications. He is in a much better position to determine the desirable tolerances than is the shop man The Brown and Sharpe Manufacturing Company of Providence, R.I., has developed a system of limits for various purposes which, in practice, work out very satisfactorily and which may be found in various handbooks. It is true that before limits can be specified intelligently the draftsman must have a good working knowledge of shop operations and of the accuracy of operation of which the various machine tools are capable. He must also understand something of the characteristics of the man in the plant where the piece is to be machined and of the shop equipment therein.

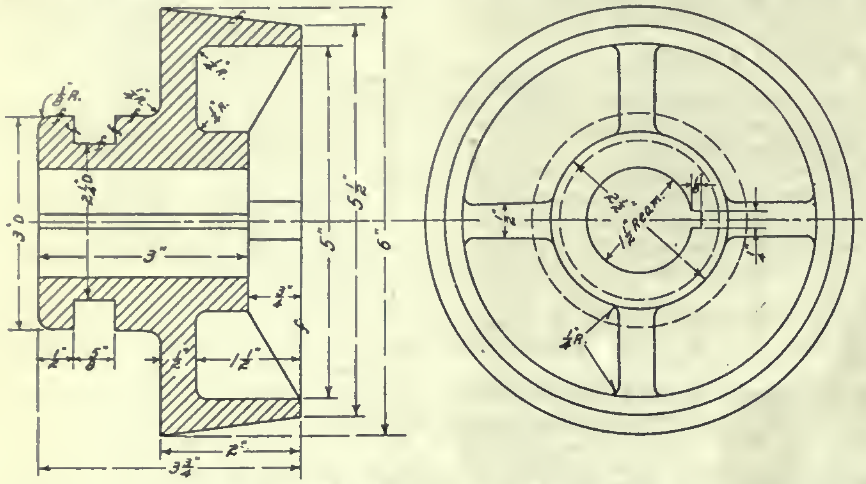


FIG. 26—CORRECT METHOD OF DIMENSIONING.

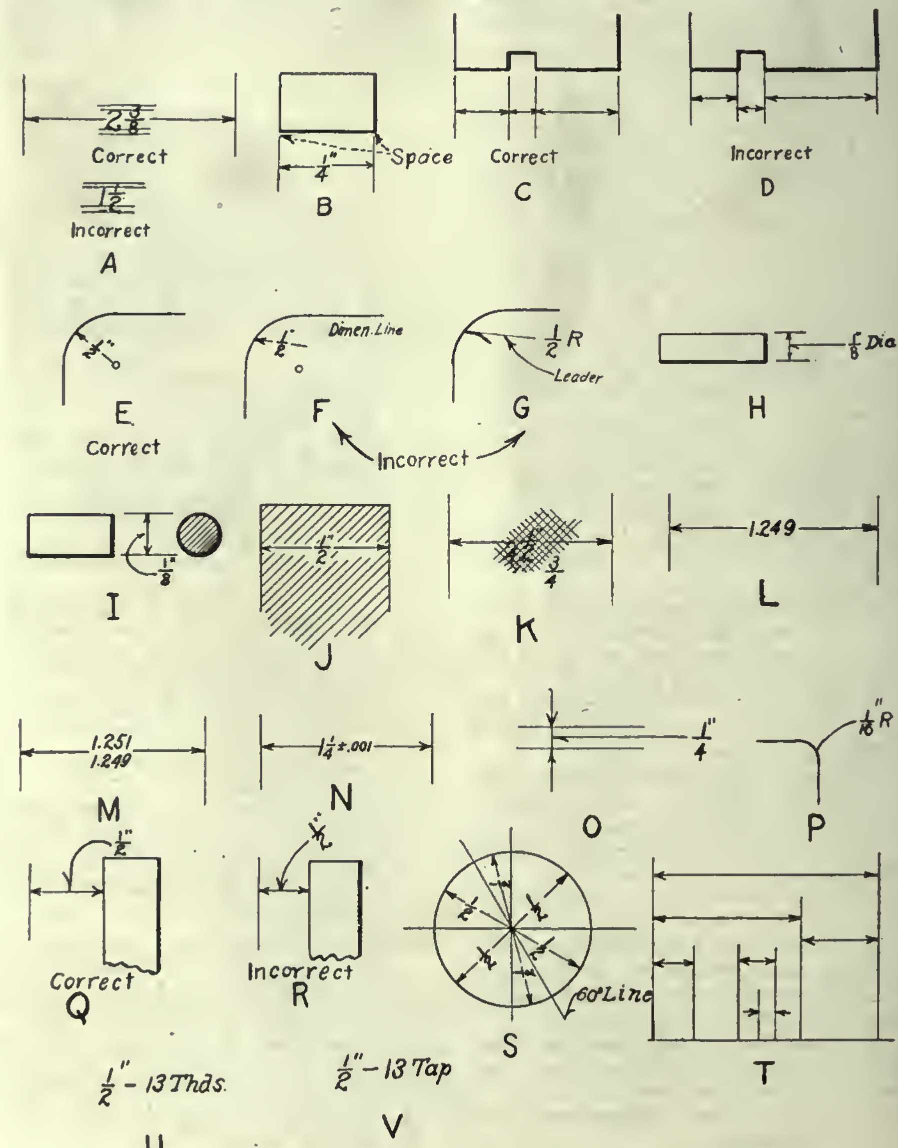


FIG. 27—FUNDAMENTALS OF DRAWING DIMENSIONING.

Vancouver Firms Pool Engine and Boiler Orders

One Order For Twelve Boilers and Twenty-four Engines Amounting to Well Over Half Million—Big Chance For Developing Carrying Trade Between Canada and Eastern Countries

BUSINESS amounting to between a half and three-quarters of a million dollars was placed with Eastern Canada concerns for contractors working on French merchant marine orders at the Pacific Coast. J. A. McCulloch, of Vancouver, acting for three firms at the coast, has been in Ontario for the past few days in connection with this work. His trip East had to do with a new form of buying that has been found satisfactory, viz., the pooling of orders and the appointing of one purchasing agent to place them all.

Mr. McCulloch has been closely connected with the munitions and shipbuilding business for some time in the West. His first experience was in the munitions business at Winnipeg, he having gone to the coast two years ago, and since then has followed the business of ship construction very closely from an engineering standpoint.

A Busy Place Now

"Shipbuilding has made the Pacific Coast a busy place," remarked Mr. McCulloch to this paper. "It looks right now as though the work in hand would guarantee that we would be well engaged for a year or eighteen months yet if nothing more turns up." Mr. McCulloch represented on his buying trip the Northern Construction Co., of Vancouver, the New Westminster Engineering and Construction Co., and the Pacific Construction Co. of Coquitlam. These companies have French orders now, 12 vessels in all. They are 1,500 ton French cargo boats, 205 feet long, 40 ft. beam, twin vertical, surface condensing engines of 275 indicated horse power. Mr. McCulloch's special business was the placing of the orders for the 12 boilers and the 24 engines needed for this work.

Can Buy Better

"We thought before, and we know now for sure that we can do better buying in this way than by each of the concerns sending a man down here to look for shop capacity to turn out the boilers and engines that will be required. If a man came into the East now with an order for a boiler and a couple of engines he would get a very scant hearing and delivery would be absolutely a matter of convenience to the shop handling the business. When a person can go to the makers of boilers and engines and say, 'Here is an order for twelve boilers and 24 engines,' we find that we can in this way secure the undivided attention of the shop and deliveries are better. This allows us to proceed at once with the construction of the vessels, and rush them along to the stage where they will be ready for the fittings to be placed in them. We know that a shipment will be coming along every month or so and this will fit in very nicely with our plans at the coast. Building ships is like making munitions. You don't want stuff piled up. You want to get a nice even flow of the necessary material to your yards just the same as keeping shells going through the various operations in a machine shop.

Who Gets the Work?

The contracts were placed by Mr. McCulloch as follows:

The Allis-Chalmers got 10 engines, of the type mentioned above, while Goldie-McCulloch of Galt will furnish 14 of the same type, 275 indicated horse power.

The first order for boilers was placed with the International Engineering Works of Amherst, N.S., the remainder having not been settled when Mr. McCulloch was preparing to leave, but this contract he expected to place before going west. In all the business was between a half and three-quarters of a million. Delivery will be made as far as possible to coincide with the progress of construction at the coast. The contractors with the French government rely on the fact that the work is for that government's war efforts to secure priority ratings that will enable them to get the material for the mechanical equipment needed.

A Great Work

"We have at the coast now six wooden and two steel yards, and there must be in the neighborhood of four thousand men working in these plants. It is estimated that a million a month is put into circulation through the operation of the shipbuilding plants. In the building of wooden vessels we are well situated at the coast in regard to timber. We can get practically everything that we need with the exception of some of the lignumvitae and other materials used for fitting."

In regard to the building of engines at the coast Mr. McCulloch considered that on the smaller types they could compete with the East, but on the larger ones it would be difficult. In fact this work has not been undertaken. The high freight rates worked against them to some extent. "But there is one thing of which I am tolerable certain," remarked Mr. McCulloch, "and that is that the Pacific coast could have had an engine building industry had they gone at it right at the start when there was plenty of work offering to give the industry the necessary work to keep going. The building of boilers could also have been established there as a good industry now. There was some uncertainty about the contracts at the start, when they did not appear to be of such a nature as to warrant much of an outlay. But the work that has been secured there lately both for wood and steel makes it certain that the boiler and engine proposition could have been established.

Looking to the Future

"What of the future? Will the shipbuilding industry be permanent in British Columbia?" asked CANADIAN MACHINERY.

"That all depends," remarked the westerner, "on whether they decide to go in and take advantage of the situation as it exists at the present time, and as it will undoubtedly exist for some time after the conclusion of the war. There is a great Pacific coast trade that is looking for some person to develop it. Some of the men at the coast claim it is the biggest opportunity that has ever opened, but it is going to take money and courage to develop it. The carrying trade from the Pacific coast of Canada to Japan and China is large and it is going to be larger. There are loads for bottoms both ways. If the Canadians don't get in and handle this trade it is going to be attended to by the people of Japan and China. That is the common belief of many of the men at the coast who pay a very great deal of attention to such matters, and there is very good reason for what they say. So far there has not been any movement made to meet this situation, but it should be handled by private interest. It is hardly a matter for direct Government action.

The Labor Situation

"How about the labor situation?"

"About the same as the East is," was Mr. McCulloch's opinion. "There have been too many strikes there on the coast. I regard the finding of Senator Robertson as a very fair and just one, although some of the labor men do not seem to see it that way. We have had no trouble in securing men for the work. Some of the men are beginning to see that high rate of pay generally brings everything along with it. It generally works out that way. Where wages run high the prices of commodities will not be far distant in the advance."

Prices for Material

In regard to prices for staple articles that go into the construction of steel ships, it is apparent that there is an advance of some size over prices here or at mills. In the matter of ship plate, it is sold from warehouse at the coast at 12 cents per pound. The Government at the present time recognize the price of 7½ cents at mills, while for points around here warehouses sell it at 10 cents per pound. Prices for all articles needed in brass trade are around the 40c mark. Mr. McCulloch believes that it is possible to establish a steel industry at the coast, and states that capacity could be secured the year around. "It is a fact, though," admitted Mr. McCulloch, "that Fernie coke has not secured the coast market, not because it is not good enough, but because the men who want it cannot depend on deliveries. There are fine ridges of iron ore near the coast. It will take capital and work to do it, but it is not impossible."

Mr. McCulloch is an Ontario boy, being born at Cornwall. He received his university course in Toronto, and has been working as a mechanical engineer in the West for some years, spending some time in Winnipeg with the Manitoba Bridge, after which he went to the coast.

A WORKING HYGROMETER

HYGROMETERS are used in factories for ascertaining the amount of water vapor in the air by means of a moving part in two forms—one employing a wet and a dry bulb thermometer, in which a fine thread of mercury is forced along a glass-tube by reason of the expansion of a small amount of mercury in a bulb. The other type owes its movement to the alteration of length of one or more hairs under the influence of a change in the moisture in the surrounding air. The movement of the hair actuates a small pointer moving along an index, and in the case of the thermometer the mercury moves parallel to the index. In each case the force represented by the movement is exceedingly small and the instruments as used in textile factories serve as a guide for the adjustment by hand of the humidifiers that furnish the additional atmospheric moisture that is required for the treatment of cotton in dry weather.

It has for many years been known that cotton is most easily spun or woven when it contains about 8½ per cent. of moisture; with less it is liable to be brittle and to have an increased loss in waste. The amount of moisture the fibre contains depends on the state of the air surrounding it, and as the dampness of the air is constantly changing, the cotton when exposed is constantly varying in weight. Along with this change of weight is a variation in thickness of each fibre, and this variation, when the fibre is spun or woven, results in a change of length in the fabric, although the loose fibre does not alter in length, nor does any vegetable fibre appear to do so.

As soon as moistening or humidifying appliances began to be used and the variation of atmosphere dampness from hour to hour during the working day was observed the need of an automatic regulator became evident, for no manual adjustment of water supply to the spraying apparatus could keep pace with the natural changes in the air. As a makeshift, the factory windows were closed and humidity was obtained at the cost of ventilation. The gain was, however, only a partial one, for excessive humidity produced lassitude among the operatives, resulting in bad work and irregular attendance.

Many inventions have been tried to obtain automatic adjustment of the moistening apparatus which used water at a pressure of about 100 pounds per square inch, but the resistance of the valves and stuffing boxes offered serious difficulties when attempts were made to control them by a movement due to the influence of moisture on organic fibrous material. A rope may be made to lift a hundredweight suspended on it by soaking it with moisture, but the operation would take so much time as to be of no use as a humidity regulator, and if it depended for moisture on the air it might take hours to show results. Promptitude is an essential in this case, for by carefully made experiments it has been found that loose cotton fibre is influenced in less than one minute by a change of moisture in the air around it.

The many failures of regulators controlling high pressure water supplies suggested a new departure, dealing with low pressure water which was atomized mechanically for air moistening. This invention was the subject of a recent patent obtained by Mr. John Wallace, of Bombay. The experimental regulator was a band of closely woven light canvas, 70 feet long, suspended by the edge beneath a roof and exposed to the influence of atmospheric change. The canvas was free of size and one was fixed, while the other was kept in tension by weight equal to four pounds per foot in width. The free end of the canvas was connected with a recording cylinder, on which a line was drawn that showed the movement of the canvas during every hour of the twenty-four. During a period of two years that the canvas remained in tension it showed no sign of fatigue, and it proved that a piece of canvas seventy feet long and three feet wide would indicate every change of atmospheric moisture in the air by a movement of 9-16 inch for each per cent. of moisture absorbed by the cotton while kept in tension by a weight of 12 pounds. The prompt sensitiveness of the canvas was due to its very large surface. Twelve pounds weight raised 9-16 of an inch thus represents the result of the absorption of 1 per cent. of its weight in moisture by the canvas band, and a test of the resistance to movement of a balance valve passing water full bore through a 1-inch pipe at one foot of pressure was 40 grammes, or about 1½ ounces.

This experiment points to the possibility of controlling automatically the supply of moisture in the air of a cotton mill, the regulator being of cotton. The canvas band has a certain length due to a content of 8½ per cent. of moisture within its fibres, and any increase or diminution of this moisture alters the length. Having a very large surface, absorption and evaporation take place very quickly, and with each change the movement acting on a balanced valve may control the water supply flowing to the vaporizers.

This device is applicable to public buildings, palaces and hospitals where electric current or other motive power is available.

CORK-LINED SHIPS

By D. Street

The efforts of all shipbuilders at the present day are directed towards making ships unsinkable by submarine action, and there are many and various means being considered as to how this can be done. However, all the deliberations have resulted in the conclusion being reached that more can be accomplished by increasing the reserve buoyancy of ships than by looking for means to divert the tremendous force of the torpedo aimed at the side of a ship. One of the methods of making ships unsinkable through the increase of their reserve buoyancy is that suggested by an Italian, whose method consists in lining all the available superficial parts of the ship's interior with a light substance such as cork. For instance, a steamer, a two-deck cargo boat, about 395 feet long and the usual lines, with a displacement of about 11,500 tons fully loaded, carries about 8,000 tons deadweight, and has about 423,000 cub. ft. of space available for cargo and bunkers under the main deck.

In order to render this vessel unsinkable it would be necessary to line the vessel internally with about 211,000 cub. ft. of cork composition having a specific weight of about 441 pounds to each 35 cub. ft. The cost of lining such a ship acording to this method would be about $200,000, whilst the capacity of such a ship would be decreased by 1,200 tons deadweight. The immediate objection to this scheme is that it is no easy matter at present to find cork in sufficient quantities to line ships. Now practicability and expediency are about the last things which enter the heads of those who propose means to safeguard ships against sinking after they have been struck by the deadly weapon known as the torpedo, against which nearly all schemes of protection adopted in the case of warships—which are not handicapped in the matter of internal subdivision through the necessity of reserving large compartments free from obstruction for the tonnage of cargo—have proved illusory, as is well demonstrated by the few instances on record of ships remaining for any length of time afloat after being struck in a vital spot by a well-aimed torpedo.

Still less commendable is a scheme put forward for increasing the buoyancy of ships by placing small watertight boxes in large numbers within the hull of a vessel and of distributing them in such a way as to interfere very little with the cargo capacity. The principle of the method proposed is that the aggregate floating capacity of the boxes will be sufficient to support the vessel and cargo after the hull is torn by a torpedo.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

RECTIFYING ROUGH BORED 155-MM. SHELLS

By M. H. Potter

INASMUCH as the most difficult operation in shell machining is the boring, considerable trouble and delay has of course been experienced in this particular operation. Moreover the government requirements upon this point are very rigid and exacting. Many shells have been temporarily turned down by the government inspectors owing to rough or scored bores. How this difficulty was overcome is fully described in this article.

The head illustrated in Fig. 1 can be used as shown in Fig. 2. The machine proper together with the shell carriage is illustrated by Fig. 5 and is described later on in this article.

The type of head shown in Fig. 1 was the outcome of considerable experimenting and produced first class results and shells rejected by the government inspecors were easily and readily rectified to their entire satisfaction.

The special shaped carborundum blocks A (see Fig. 1) are clamped in the jaws B as shown by the bolt C. The jaws B pivot at D. Naturally when the head is rotating centrifugal force throws the blocks A against the bore of the shell. This head was run at about 1,500 revolutions per minute.

The illustration, Fig. 3, although a different type of the head, is operated on the same principle. This head was designed to overcome the trouble and delays in production due to rough boring in the forward end of bore, after the nosing in operation. Owing to the rather small aperture a number of various designs were made up and tested, but the one herewith described was the only one which produced satisfactory results. Fig. 4 shows this head in the shell. The tubing A (Fig. 3) should be as large as permissible, the smaller tube B has an outside diameter that is about 1-32 in. to 1-16 in. smaller than the inside diameter of the tube A; in other words, when A is

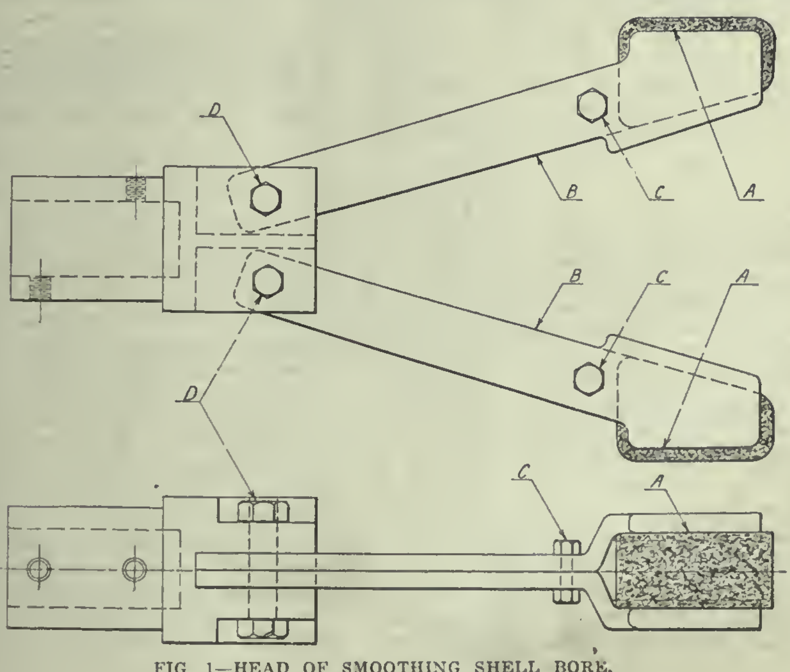


FIG. 1—HEAD OF SMOOTHING SHELL BORE.

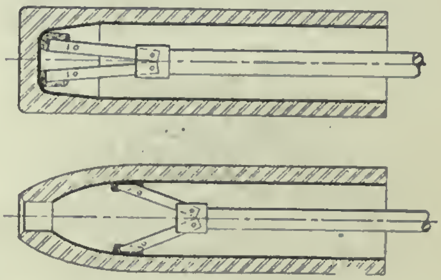


FIG. 2—OPERATION OF HEAD.

milled out half-ways B will just fit inside. The tube B is pivoted in the tube A at C. The carborundum block D is clamped by means of the bolt E. The flat arched spring G throws the jaw B outwards so that when the head is revolving it is subject to centrifugal force.

Fig. 5 shows the machine proper to which the heads previously described were used on. The shaft A (Fig. 5) is mounted on the two self-oiling rigid pillow blocks B and C. The tight and loose pulleys D and E are provided with an ordinary type of overhead belt shifter. The head stock casting G is bolted to the two structural steel "I" beams H, which form the bed. The legs I and K are also bolted to the "I" beams H. Owing to the excessive vibration rigid and heavy construction was maintained throughout. The carriage L, which supports the shell (shown by dotted lines) is mounted on flanged wheels and is reciprocated along the angle irons M. Two of the four shell carriage brackets N and O are hinged to permit rolling the shells in and out, the bench being in direct line with the shell carriage (at its back position, as shown in Fig. 5) to do away with unnecessary handling of the shells. The smaller sized shells (6 in. or under) will have to be clamped in the carriage to prevent them from rotating when being ground.

A NEW SHOCK RESISTING CONCRETE

By M. M.

Oil-mixed concrete we know; now comes an engineer and inventor (Mr. Lucien Linden) who patents a concrete composed mainly of Portland cement with particles of moss, turf, or wood (pulverized or pulped) and ores of metallic particles, with a binding liquid consisting of a soluble salt of alumina, lime and water. In addition, for concrete that will be much exposed to humidity (in foundations, for instance) or to violent shocks (in fortifications),

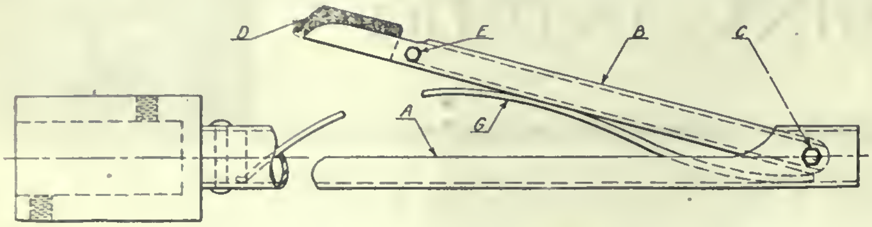


FIG. 3—ANOTHER TYPE OF HEAD.

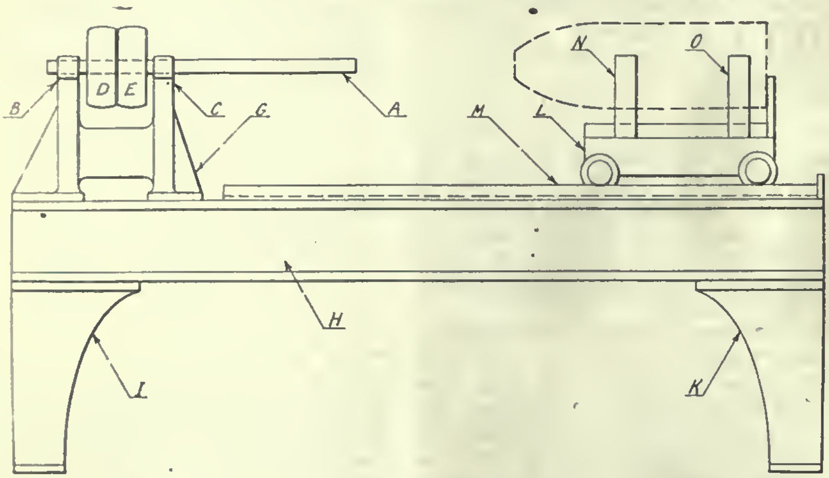


FIG. 5—SHELL CARRIAGE.

it may be advisable to add grease or oil, the fatty elements being introduced into the cement paste during the building operations.

The inventor advances the theory that the oil or grease will be progressively removed so soon as the paste becomes solid. They will spread all over, or progressively as oil stains in isolated spots, in the compound formed, so that greasy zones will be found encroaching upon hard and dry zones. The latter by acting in opposition, will impart to the thus formed bodies or structures a resiliency which will resist the disintegrating action of vibration or violent shocks. The fatty elements may be provided in the shape of pumice stone the size of peas, or of fragments of cork

FIG. 4—ACTION OF HEAD.

similar substances first dried and then soaked in fat, oil or grease.

The inventor states that the best method of producing such "grease zones" is to stretch through the soft cement paste straight layers of oil-soaked strings or cords. Generally a string provided in the centre of a body 3 in. thick, for instance, will suffice, many such strings, arranged net wise, to be used when forming concrete blocks. Similarly, strings that have not been oiled may also be used. The strings (greasy or otherwise) have also the effect of producing "isolated stretches" which arrest shocks, vibrations or other external or internal influnces which often cause ruptures. The strings or nets may be alone or arranged in conjunction with metal reinforcements.

The following, which the inventor gives by the way of exemplification, are said to yield excellent results:—

Formula No. 1.—(a) 100 parts of strong cement; (b) 5 parts of moss or turf well dried and finely cut and pulverized; (c) 20 parts of ore rich in iron in fine particles. These substances are formed into a paste by vigorous and prolonged mixing with a binding liquid, which liquid may consist of 5 kilograms of quicklime new from the kiln and broken up just before use, and of 3 kilograms of pulverized sulphate of alumina vigorously worked up in a cubic metre of clean water. This binding liquid plays an important part in the composition and amalgamation of the paste.

Formula No. 2.—(a) 100 parts strong cement; (b) 20 parts of soft wood (fine sawdust); (c) 10 parts of iron ore in particles, the whole being amalgamated with the same binding liquid as in formula No. 1. The above proportions (all by weight) and composition may vary according to the nature of the construction and use in view. Formula No. 1 is suitable for the construction of pipes, or ships; and Formula No. 2 can be used without any metallic truss rods or bars or wires, obtaining a material intended for doors, frames, packing cases, or rofing o rthe like.

Both of them may be adopted in a more diluted state, to make, when associated with gravels or fragments of bricks or stones, high class resilient concrete for foundations, walls or fortifications.

The reinforcement bars, rods, or wires, used with such compositions are preferably articulated, not fastened to one another, but indirectly connected together at the points of junction by means of insulating material capable of yielding.

Concrete made in accordance with formula No. 1 is so resistant and withstands expansions and contractions with such efficiency that it is also unnecessary to put hoops round the pipes even when the latter are liable to be subjected to high pressures. It is essential to work up vigorously and continuously the ingredients when they are mixed with the binding liquid.

The binding liquid is best prepared in a mechanical mixer, and the vegetable particles must be thrown into it and left for the former to act thereon, after which the cement is slowly introduced and then the metallic ore or ores pulverized or in small particles. The working up must be continued without interruption throughout the whole time during which it is formed and applied.

The successful use of the concrete depends on practice and experience. The material is especially adapted for high-grade construction such as ships. It can also be applied with advantage in the construction of pipes for water and gas, casks, boats, pontoons, reservoirs, railway sleepers, rail supports, floors, roofs, and walls.

MAY ESTABLISH LIGNITE PLANT

ESTABLISHMENT of a lignite briquetting plant, to be financed and operated by the Dominion, Manitoba and Saskatchewan governments, is recommended by the lignite committee of the Advisory Council for Scientific and Industrial Research. The committee report, which will be issued shortly, favors establishment of the plant in southern Saskatchewan at a locality where the lignites are of poor grade, with the idea that if it were successful at this point, it would be successful elsewhere in Saskatchewan and Alberta.

The report further states: "The art of producing carbonized briquettes has passed the laboratory stage and no further information can be got by laboratory methods. The producer must face the difficulties in commercial production, which are approximately of the same order as those within the smelting of certain ores. The road to success in the briquetting problem is strewn with the wrecks of amateur attempts to do this apparently simple thing, which accounts for the fact that private capital is so chary of such enterprises.

Labor Saving Washing Device Used on Shell Work

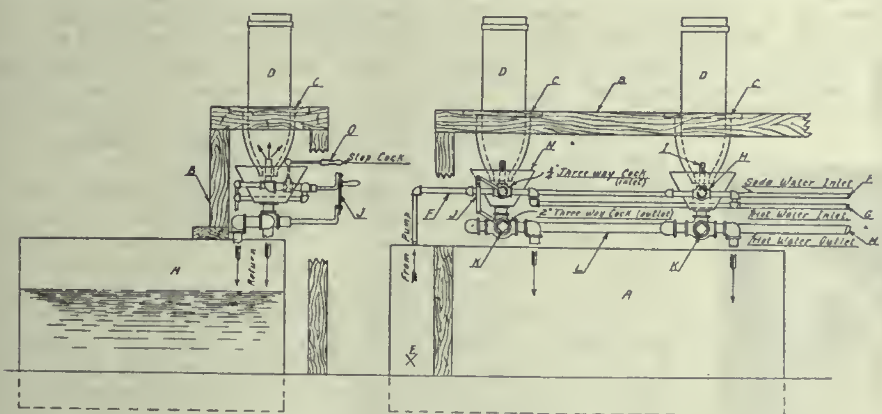
Absolutely Necessary to Have Interior of the Shell Perfectly Clean Before the Varnish is Applied—Various Methods Used and Good Results Not Hard to Obtain

By J. H. RODGERS, Assoc. Editor Canadian Machinery.

BEFORE the varnish can be applied to the interior walls of the shells it is necessary that every particle of foreign matter be removed to insure the adherence and uniformity of the coating. If this essential precaution is not taken the possibilities are that the varnish will not cling to the surface in a manner satisfactory to the inspectors, and invariably requiring the removal of the objectionable coating.

Various methods have been adopted for this purpose but the two more generally used are sand blasting and washing, or in some cases a combination of both. The device shown in the accompanying cut illustrates an arrangement for washing the six-inch shells, and one that has proved very efficient. As is usual by this method the shells are subjected to a spray wash of soda solution, followed by a rinsing with clear hot water. Little variation is made by different firms in the actual washing operation, but the method of application is seldom the same in any two plants.

Conservation of labor is one of the recognized factors in the operation of munition plants, so that the trend has been to eliminate all unnecessary handling of the work as it progresses through the shop. In many plants this washing operation is accomplished by placing the shell over two separate nozzles, one for the soda and the other for the clear water. With the device here shown these two washes are obtained with the one setting of the shell by a suitable arrangement of piping that permits almost instantaneous change from the soda to the clear water. The apparatus is so designed that washing of six shells can be proceeded with simultaneously, although this could be modified to suit any particular requirement.



DEVICE FOR SHELL WASHING.

Two adjoining tanks A are located in a convenient position with their bases placed below the floor level. The framework B is attached to the tanks and of ample height to support the shell above the nozzles. At intervals along the upper board are located bell-shaped castings C for holding the shell in an upright position. A small centrifugal pump E is placed on the floor at either end of the tank for forcing the liquid into the interior of the shell, the soda passing through the pipe F and the water through the pipe G. Three-way control valves H and K are operated in unison by the link J, this being connected to the valves by the levers shown. The soda return is by the pipe L and the hot water through the pipe M. Funnel pieces O are provided to avoid splash of the liquid.

THE SALVAGE OF SUNKEN MERCHANT SHIPS

By M. L.

There are now lying at the bottom of the sea with their valuable cargoes a great number of merchant ships, torpedoed by German submarines. Must they lie there forever or can they be refloated, as Germany is reported to have refloated and taken into Antwerp the North German Lloyd liner, "Gneisenau," which was sunk at the beginning of the war in the Scheldt? There appears to be very little doubt that many of the ships can be floated, and that a considerable quantity of cargo can be salved. The North Sea is sufficiently shallow for diving for cargoes, but there are a good many ships sunk in comparatively shallow water, which could be raised now if there were the men and the plant to do it.

There are few, if any salvage divers left. What salvage labor and machinery there was available in the British Isles has been requisitioned by the British Admiralty, and the same holds good in other countries as well. These men and plant are doing considerably more valuable work in helping the naval authorities than in looking after the commercial possibilities of salvage. In this, as in other matters, nothing can be done until after the end of the war. Then there will be possibilities for salvage work on a considerable scale, both in the North Sea and parts of the English Channel and other parts where the water is fairly shallow.

As to the question of deterioration, the fact is that neither ships nor cargoes, except perishable materials and foodstuffs. deteriorate very much in water. The chief damage that a ships suffers is when she is only half submerged and the engines are left to dry in the wind. Usually, when a vessel that has been wrecked is being refloated, a barrel of oil is poured on the surface of the water in order to leave a deposit over the machinery. Repairs are quickly effected, and sections torn by rock or torpedo present no great difficulties in the work of salvage, for they can be completely repaired. Valuable as are the ships themselves that now lie at the bottom of the sea, the cargoes of cotton, rubber, wool, cotton goods, machinery, and other materials are more valuable still.

The legal rights of salvage are those between the persons who are prepared to salve and the owners or underwriters of the vessels. A salvage company, for example, knowing that a vessel with a cargo of wool or cotton, has been sunk at a certain spot, will notify the underwriters that they are prepared to salve the cargo, and perhaps the ship, and they offer to do it. The question of the three-mile limit is not likely to arise. It depends on the terms of peace whether it will be possible for German companies to offer to salve the British ships they have sunk, and upon the feeling of British underwriters in the matter of whether they could consider them. There is no reason to suppose that Germany would be better equipped for the work than those of firms in other countries, but some of the German companies have more steamers but a much less amount of machinery. There are also good salvage plants in Holland, Sweden and Denmark, and doubtless they, too, will want a share of the valuable cargoes now strewn over "Davy Jones' locker."

Production costs at the plant for carbonized and briquetted fuel, covering operating costs and fixed charges, are estimated at not more than seven dollars per ton. In this estimate no finance allowance has been made for the recovery of by-products, which are stated to be large and valuable.

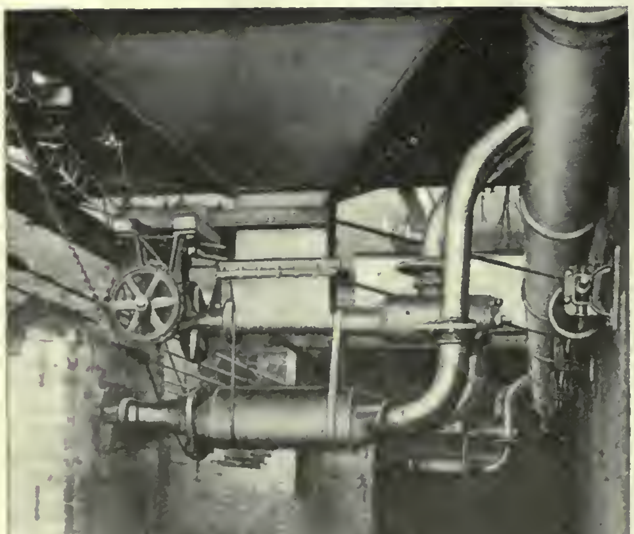
DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

POWDERED COAL CUTS COAL CONSUMPTION ON ANNEALING OVENS THIRTY PER PER CENT.

AT the present time when every effort is being made to spin out the energy of the coal pile and conserve our resources, the achievement of the American Radiator Company in very materially increasing its annealing oven capacity while at the same time effecting a startling economy in the consumption of fuel is of decided interest to industry in general.

The malleable iron plant of the American Radiator Company at Buffalo, N. Y., has long enjoyed the distinction of producing a superior grade of annealed castings under conditions of marked fuel economy. The annealing ovens have been equipped for burning powdered coal, the average consumption having been approximately one pound of coal to 3.5 pounds of castings annealed, the furnaces running about 96 hours per heat.



About the middle of November two annealing ovens, equipped with the Pruden carbureter, burning powdered coal under the carburization process, installed by the Powdered Coal Engineering & Equipment Company, Chicago, Ill., were fired and run for 96 hours. The first castings ran through the ovens before they had been dried out and the brick-work was extremely wet for the material had been lying in the open from three to four months and had become thoroughly saturated with water.

Mr. Harry E. Kies, manager of the malleable iron department, stated that upon completing the dumping of castings from the No. 4 oven he had never seen iron in quality and uniformity to equal it. Every piece had been perfectly annealed and these pieces were 25 per cent. tougher than anything that had ever been secured from the other furnaces equipped with the old burners. He stated that the saving in coal would be around 30 per cent., and that the next ovens would comethrough in 72 hours.

The burners ran all during the heat with no attention or adjustment, the operation was practically smokeless and observations made in the combustion chamber and flame passages showed that the ovens were heated to an absolutely uniform degree of temperature and that the flame circulated in every part of the ovens; on each side, around the bottoms and at the extreme back ends of the pots.

Examination of the ovens after the castings had been dumped showed that there had been no erosion or destruction of brick-work, indicating that with the new type of burners shut-downs for repair of brick-work would be reduced to a minimum, while the uniform degree of heating over the entire oven area, with consequent elimination of intensely hot zones indicated that pot losses (renewals) would be materially reduced.

Efficiency of coal consumption was increased from the previous record of one pound of coal to 3.5 pounds of castings to one pound of coal for 5.71 pounds of castings.

The coal used was a good grade of Kentucky bituminous, averaging about 12,500 B.T.U's.

		Carbon Briquettes.			
	Price of U.S. anthracite per ton f.o.b.*	Freight rate and switching from Bienfait	Estimated cost f.o.b. cars	Selling price profit of $1.00 per ton f.o.b. cars	Difference in favour of carbon briquettes
Winnipeg	$ 9.50 to $10.00	$1.90	$9.15	$10.15	$.... to $....
Portage la Prairie	10.00 to 10.50	1.80	9.05	10.05	.45
Carberry	10.55 to 11.15	1.60	8.85	9.85	.80 to 1.30
Brandon	10.60 to 10.85	1.50	8.75	9.75	.85 to 1.10
Virden	10.80 to 12.15	1.60	8.85	9.85	.95 to 2.30
Moosomin	11.00 to 12.25	1.80	9.05	10.05	.95 to 2.20
Wolseley	11.50 to 11.75	1.80	9.05	10.05	1.45 to 1.70
Regina	11.50 to 12.25	1.60	8.85	9.85	1.75 to 2.40
Moose Jaw	11.45 to 12.35	1.50	8.75	9.75	1.70 to 2.50

*Owing to the steady exhaustion of the anthracite resources of the United States, these prices will increase year by year.

VICTORIA, B.C.—Franklin Remington, president of the Foundation Company, wired Premier Oliver from New York as follows: "Have closed contract with the French Government for 20 wooden steamers. Will need our yard and also the Cameron-Genoa yard, as we have undertaken to lay down ten ways."

Optical Devices Aid Science and Industry

Combination of Optical Principles Enable Remarkably Interesting Results to be Achieved in Many Directions Impossible With the Telescope, Which Forms the Basis of all the Applications

IT seems hardly possible that the functions of a microscope, telescope and tele-photography could be united in one instrument, but the instrument herewith described accomplishes these things and in a maner which adds greatly to the usefulness of any standard microscope in the machine shop or other industrial plant.

Messrs. Davidson and Co., Great Portland St., London W., have recently produced a "micro-telescope" which is essentially an instrument consisting of a microscope of ordinary construction carrying a short focus telescope objective and tube below the stage. The ordinary terrestrial telescope consists of an object glass and an eyepiece which is nothing more nor less than a microscope of low power.

As well as supplying the instrument complete the makers manufacture two micro-telescope attachments, one for any distance from 3 feet to infinity and one of short focus for work from 12 to 24 inches. These attachments are made to fit the Abbe rim of any standard microscope and consist of a tube supporting a finely wrought object glass and a correctly graduated series of stops for the prevention of halation, the microscope becoming the eyepiece of the objective.

The focal range of the instrument complete is remarkably deep, the upstanding character of moss, lichen or fungus is clearly visible and in focus throughout. Dots on a card as close as 40 to the square inch are easily counted with this instrument at a distance of 3 feet. In the workshop, shafting, etc., or a part of a machine can be easily examined if light is thrown on it and with the use of a mirror to reflect light it is possible to inspect tubes of any length. Scales on thermometers can be easily read at a considerable distance and in ore smelting, glass, china, pottery and enamelling works and engineering shops, processes of firing and the action of furnaces used in heat treating, forging and other metallurgical operations can be closely observed at a comfortable distance.

One application of this attachment in the machine shop is the examination of the machining of a piece of metal that could not in the ordinary way be placed under the microscope.

With the use of a camera as shown in Fig. 3, it is possible to photograph whatever is seen by the use of the appliance and exposures as short as one-half second are possible. By means of the apparatus photographs of very distant objects can be secured.

FIG. 2—MICRO-TELESCOPE WITH SHORT FOCUS ATTACHMENT FOR OBSERVATIONS AT CLOSE RANGE, 12 IN. TO 3 FT.

In addition to the micro-telescope described the firm manufacture what is termed the super microscope for magnification up to 500 diameters at working distances of from 1½ to 1 inch. Ten times this magnification can be secured, but the working distance of the objective from the specimen is reduced in proportion. Up to 500 diameters the super-microscope can be employed without the mechanical stage for examination of objects too large for the stage.

The power of one microscope shown in Fig. 4 is in this instrument added to that of a secondary microscope the full combination being shown in Fig. 5. The primary shown to the left in Fig. 4 has a tube having stops and the micro objective to the right passes over the primary and carries a stage actuated by rack and pinion for vertical and lateral movements. Coarse adjustment of the secondary microscope forms fine adjustment for the super microscope, fine adjustment of the secondary then giving the extra fine adjustment.

An Abbe condenser can also be mounted and photographs are readily taken.

FIG. 1—MICRO-TELESCOPE FOR OBSERVATIONS 6 FT. TO INFINITY.

WATER POWER

By Mark Meredith

There can be no doubt that the nation would gain immensely by the cheap electricity which the promised sixteen pit-head power stations would make possible. But the setting up of these stations ought not to prevent us from giving every consideration such as, happily, is being given by the Ministry of Munitions to the developments of water power. We can never have too much power—the very lifeblood of industrial progress in this country; therefore we welcome every efficient addition to the resources of the nation in this direction of electric power production, whether that addition be coal produced gas-power or steam-power, or water-power.

There have been found in Egypt engravings of water wheels used by the ancient Egyptians on the Nile for grinding corn. The existence of such a machine is mentioned in the year 85 B.C., and Strabo records that Mithridates, King of Pontus, had a water mill. There were mills in Europe at the period of the Roman Justinian Code. The practice was often to moor barges in rivers, whose current in sweeping by slowly turned wheels on horizontal shafts projecting from the sides. This type of mill is to be found even at the present day in South Europe. Water power was used extensively in England over 1,000 years ago, the wheel being horizontal, and mounted on a vertical spindle carrying the mill stone.

The overshot wheel is the oldest and most extensively used. The water is led to the top of the wheel, in a direction almost tangential to the periphery through a chute called a "head race." The buckets become filled, and are carried down by the weight of the water. Actually, as the buckets tilt in descending, a considerable part of the water is lost en route. Thus the work which could be got from the water in falling from the head race to the exhaust, or "tail race," cannot be utilised. The wheel has to be nearly as high as the total fall of water, which should not fall more than 2 feet from the head race to the first bucket. It has also to be made just to clear the tail race water, which would otherwise retard its motion in flowing away. The diameter of wheel is thus only a few feet less than the height through which the water falls. Wheels of 80 feet diameter have been constructed. The loss due to water leaving the buckets may be minimized by careful design of their shape. With a well designed wheel as much as 85 per cent of the work available in the water can be utilised. An important point is that the machine is more efficient at low speeds, when less water falls out than at high speeds.

FIG. 5—SUPERR-MICROSCOPE COMPLETE FOR VISUAL OBSERVATIONS.

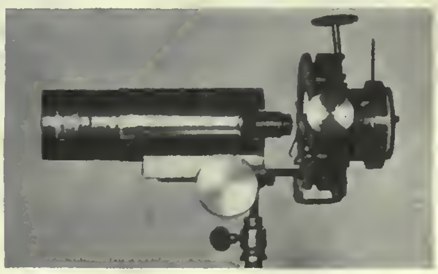


FIG. 4—THE PRIMARY MICROSCOPE WHICH ADDED TO THE SECONDARY OR REGULAR MICROSCOPE FORMS THE SUPER MICROSCOPE.

In the breast wheel the water enters at about the level of the axle, and is conveyed to the buckets by a circular arc of masonry or wood which fits closely to the edge of the wheel. Here the propulsion is partly by virtue of the weight of falling water, and partly due to the velocity in the tail race into which the buckets dip, the direction of motion being the same in this case. The flow from the head race is regulated by an adjustable sluice with passages so designed as to lead the water on to the wheel smoothly without shock. In some wheels, called "high breast" wheels the fall is almost as great as the diameter, and the efficiency is much the same as that of an overshot wheel. With a "low breast" wheel where the fall is less, the efficiency may be about 50 per cent. With the under shot wheel the water is confined against a lock gate and issues underneath through a sluice, impinging on radial vanes on the wheel. The wheel is moved solely by the impact of the water, whose dead weight plays no part. The wheels of Southern Europe are of this type and their efficiency is only 20 to 25 per cent.

The water turbine can be constructed for the largest powers and is immensely superior to all its rivals for efficiency. A gas engine of the best type will not yield more than 40 per cent of the energy of combustion of the fuel: a steam engine will yield less than 20 per cent of the energy in the steam supplied (neglecting foregoing losses in furnaces, boilers, pipes, etc); but a hydraulic turbine will give an overall efficiency of 75 per cent

FIG. 3—MICRO-TELESCOPE WITH LONG FOCUS TELESCOPE ATTACHMENT FOR PHOTOGRAPHY AT AND DISTANCE BEYOND 6 FT. IF THE SHORT FOCUS ATTACHMENT IS USED PHOTOS CAN BE TAKEN OR OBSERVATIONS MADE AT FROM 12 IN. TO 3 FT.

A "House Organ" Sliced Up and Gazed Upon

And it is Shown How the Little Paper Puts the Millstone Around the Neck of a Whole Lot of Good Business Prospects—A Power For Good Kicked Into the Scrap Heap

Written by the Coroner Himself.

ARE house organs a paying investment? The writer will have the courage of his convictions and say, decidedly yes, providing they are run properly.

Because they are not run properly, it does not mean the idea is wrong. The idea is sound enough, it's execution that is usually faulty, hence the high mortality rate.

The large percentage of house organ failures is principally due to one particular fault, and that fault most always lies with the actual producer, or in other words the editor. He is prone to lose sight of the fact that there are, or should be, two distinct kinds of house organs, the internal and external, and because of this fact, the inevitable catastrophe happens, and mostly in this way.

A man or firm decides to publish a house organ with the idea of reaching their customers in a more direct and intimate manner. Fine. They spend plenty of money in securing the right kind of booklet. Fine again. They get the very best printer and engraver to combine their efforts so far as the appearance of the booklet is concerned. First rate. Then what do they do? They commence to assemble the reading matter. Watch out now, this is where the internal and external house organ are liable to get mixed. This is where the distortion of viewpoint comes in, and incidentally, where the label is affixed for the morgue.

Your editor maybe is first rate, in some respects, the only thing he lacks is experience in editing house organs. He may be a high class advertising man, full of pep, brilliant of inspiration, but he does not know house organs, or their funny little ways, therefore, he sets to work to entertain and interest his readers. And this is what he usually does, minus the diagnosis of his readers' needs.

He Heads For The Swamp

He will write a snappy and witty editorial, outlining the policy of his house and explaining the purpose of the publication. Great! He will then proceed in terms couched in sarcasm and satire, to give his opinion, not even the opinion of his house, mind you, but his personal opinion on some predominating political subject that might at the moment be worrying the country. Utterly wrong. He's paving the way for some enemies anyway. Then he will sandwich in a couple of pages devoted to his product. Fine again, so long as he only uses two pages and does not try to bulldoze his prospect.

And then—oh yes, he has a few good (?) jokes on hand—he uses these. They are bright but questionable; they have a distinct double meaning, and do not by any means reflect the dignity of the house. But still, our editor is a live wire, full of pep, and in they go. Wrong again; he loses more friends. If people want this sort of thing, they can buy books that contain it served up even more deliciously.

Goes Absolutely To Seed

And then he proceeds to put his foot in it still further; he commences a long-winded story about Bill Jones who has been in the service of his house for a number of years. More than likely Bill is a friend of his and does not object to reading nice things about himself, particularly if the article is adorned with a half-tone cut and amply retouched. Bad judgment again. The customer does not want to be informed regarding Bill Jones, even if he is the superman he is painted. Bill never entered into the customer's life, and in all probability the customer does not want him to.

Neither is the customer interested in George Giles who has worked for the company for sixty years, and is the head of three generations. That's not original, neither is it news; there are thousands of this type and our editor has absolutely no monopoly. Bill Jones and George Giles distinctly belong to the internal house organ and it's doubtful even then, because the other employees of the house have known it for years and are sick of hearing about it, especially of Bill Jones the superman, for the reason that they see Bill from the other side of the fence in his morning wrapper and boudoir cap, and with his hair in curl papers as it were.

Draws Deep On Imagination

So having committed himself so far, our editor continues to his doom. He selects a "real" sales story written by a man who couldn't sell goods if he tried, who tells how he entered the presence of a prospective customer with his hat on and a cigar in his mouth at an angle of forty-five degrees and sold him to the extent of $25,000. He tells all this not from experience, but from imagination and for sake of argument from some back garret situated in New York City. He omits to say, however, that his own ability as a salesman would be on a par with the memory professor who forgot his umbrella when calling upon a client.

And so our editor jogs along. He continues to do these things until the dummy is ready to submit to his president or manager. And the manager, he takes it for granted that it's all right for the simple reason that the editor had previously told him it was "easy to run a house organ." So it is mailed to the customer.

And What Does The Dealer Do?

And the customer? It's a new publication, therefore he'll likely read it. He gets through the editorial and on the strength of it reads further along. He comes to the expression of opinion on politics—and frowns. Out of curiosity he proceeds to the jokes—and rips out the page because he has several lady stenographers around. The mention of products is sidetracked for future reference, taking care that there are no more jokes on the other side of the page; and then he comes to the history of the superman, Bill Jones. At this he sneers, actually sneers, mind you, and says under his breath: "What the devil has Bill Jones got to do with me?"

About here he will be getting impatient, therefore poor old Giles gets short shrift, in fact nearly gets thrown into the paper basket; would have been in fact, only that a heading on the next page saves the situation. "How to improve your sales staff" is what meets his eye. He reads, he still reads, because utter rot is sometimes fascinating and then, "Hell, can you beat that?" And into the waste paper basket goes the child of our editor's brain.

THE majority of power plants of to-day have adopted CO_2 recording or indicating instruments in some form or another. These with other means of checking plant performance go a long way in the conservation of fuel.

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When Is a Gamble Not a Gamble?

LAW is a sort of a funny thing after all. A merchant in Brandon is in a peck of trouble. He had a window with grab-bags in it. Some of them had something worth while, while others had not. The person who was willing to pay 25 cents took the chance of getting little or much. He might emerge from the scramble with a diamond that would sparkle like a new barn lantern, or again he might draw a prize that would look cheap in a bag of popcorn. At any rate the police got after the man and he's now up to explain his conduct on the charge of gambling.

At almost any large fair, exhibition or travelling circus there are a number of things go on that would make this practice look as flat as a well-made buckwheat pancake. There are straight games of chance run at all these affairs. Money is taken where only one in ten persons has a chance of winning. They toss balls and throw rings and try to beat sharpers at their own games. In fact, the stuff that is allowed to get by would make the wee sinner from Brandon look like a miserable amateur when it comes to real gambling.

But did you ever hear of many convictions against the circus people, or against the sideshow ilk that operate the large fairs or circuses? No, you did not. Occasionally there is a bit of a protest against the practice, but when it is made it is a lame duck and gets nowhere at all. The authorities reserve their powers of domination until they round up a few poor harmless Chinamen who are having a game of fan-tan and amusing themselves in this way. They are not out to bamboozle the public, but the authorities become wonderfully interested in the protection of the few Chinese who may lose their week's laundry cheques in this way.

The interpretation that is placed upon the meaning of "gambling" by the law interpreters is a gloriously vague and peculiar thing.

Larger Place Needed For Machinery

IT is quite evident that the Machinery Hall at the Toronto National Exhibition is quite out of keeping with the importance that the machine tool business and other lines of engineering product are taking on in the Dominion. There is small encouragement for the men who are in the business to go ahead and make a display truly representative of the industries in the building at their disposal.

There would have been a splendid chance this year to demonstrate at the fair the manner in which war work is carried on. True in some cases a few rough turning operations were in the course of actual work, but they gave no idea of the magnitude of the industry that has meant more to Canada in a commercial way than anything that has happened in her history.

There were great displays of material and processes that by the War Board would be ranked as non-essential in these times. There should be a determination on the part of the management to have the exhibits truly representative of the real things that are happening right at the time.

Of course, there are dealers, and many of them, who do not see any return for the expense of exhibiting at the Toronto fair. They claim that they can get better results in straight advertising, and that if they do put in a display in operation it is simply clogged with spectators who would never have any more occasion to buy a lathe than a barber would a bread mixer. The present facilities and the location of the building tends to encourage the manufacturers in this belief.

The Merchant Marine Should Be Recognized

THE week from September 1 to 7 is to be set aside in the Dominion as Sailors' Week, with the special purpose of raising money for the support of the dependents of those who have lost their lives while serving on the British Merchant Marine.

With the object there can be no quarrel. There is not even room for a good argument concerning the wonderful service performed on the trade routes by the gallant men of the Merchant Marine.

But with the system that allows the dependents of these men to be made the objects of a week's pity and hat-in-hand giving there is every fault to be found.

Why should there be no pensions for those left behind by these men? Is their service not as worthy of recognition as that of any other branch? Is the work they perform less honorable and less vital to the existence of the nation?

Not a bit of it. The great bulk of the hardships on the seas in this war have been endured by the men of the Merchant Marine. They have seen more of the submarine than any other branch of the service, and they have been instrumental in carrying men, supplies, ammunition—in fact everything that has enabled the Allied armies to carry on the war in the different fields.

In the face of the submarines, of the floating mine and the sunken mine, the men of the Merchant Marine went ahead, and with a courage that was wonderful and a tenacity of purpose that was traditional, turned an adverse balance in 1913 into a trade balance in 1917.

If the men of the Merchant Marine had shirked, this work would not have been done. The men in the front could not have been fed. The supplies and munitions could not have been sent across. The commercial supremacy of Britain could not have been maintained.

The service of the Merchant Marine is not a mean service. It is deserving of real and substantial recognition. It is not enough to depend upon "Sailors' Week," or tag days or voluntary giving. It should be recognized and rewarded on a straight and decent basis. There should be pensions and allowances for dependents of those who lost their lives in the service of the Merchant Marine, and it is high time the matter was put on the permanent basis that it deserves.

STEEL is quite an aristocrat. It has elbowed and fisted its way to the top of the price heap. Time was in days of old Pittsburgh production when as low as $1.05 per hundred was the market price. But prices in Canada are far removed from such lowly circumstances now. Price advances have came, but Steel has romped over the hurdle with ease in each case, and shows small tendency toward getting its heels going the other way. The man who pays the maximum $10 per hundred for plate now must regard the chap who used to pass it out around the $1 mark as a poor prune when it comes to a matter of salesmanship.

GREAT VOLUME OF BUSINESS PLACED

Big Overflow of American Orders Will Keep Plants Busy In Dominion

Canadian makers of munitions in recent months have secured American orders to the amount of nearly one hundred million dollars, and the prospects for the orders being doubled and trebled in the near future are said to be most promising.

The United States campaign of expansion of war effort as has been pointed out, is on such an elaborate scale as to tax all of their own industries and cause a big overflow to Canada. There are consequently the greatest possibilities for Canadian manufacturers benefitting with orders to an extent much in excess of the past.

The discrepancy in prices paid for munitions in the United States and Canada in certain cases is explained by the fact that on the other side manufacturers new to the business have, on the initial orders, been allowed a rate having regard to their capital outlay as was the case at the inception of the shell business here. When the industry is fully established the situation is different, and no allowance is made for the primary outlays on plant.

The appeal of the Munitions Board for increased output has met with a splendid response by munition makers all over the country. The prescribed limit is being fully lived up to, and the prices allowed are regarded as wholly satisfactory.

Cabinet Studying Matter

After discussing the matter with Mr. Harris, a sub-committee of the Cabinet was appointed to confer with him and the War Trade Board and work out details of a plan which will combine effective aid in the war, and at the same time stimulate the trade and industry of the country. The ground will be gone over and the capacity of Canada to do its part will be fully investigated.

One effect of the proposed plan will be to reduce the adverse balance of trade by greatly increasing the volume of Canadian exports. It is presumed also that restrictions applied by the United States on the export of certain raw materials will be moved in order to facilitate Canadian manufacturers in turning out munition and equipment orders designed for the common purposes of the war.

Upwards of a hundred million dollars of American munition orders have already come to Canada. There is some complaint, now the subject of negotiation, that the prices paid by the Imperial Munitions Board for the British army is considerably below those which rule in the States for similar work, and also below what is paid by the States to certain Canadian manufacturers who have secured orders independently of the channel of the Munitions Board.

CAPE BRETON GIRL WAR WORKERS BUILDING BOATS

Fourteen Are Now So Employed by Dr. Graham Bell at Beinn Bhreagh, Baddeck

The first that Cape Breton has seen of the real work of women as regards war work in the actual and practical labor side of it is in shipbuilding. Many of the young women in the city have read of the activities of women in the United Kingdom, the United States and in Upper Canada as farmers and munition workers, but here in Cape Breton they are building boats and for Government purposes at that.

Down on the Bras d'Or Lakes, where Dr. Alexander Graham Bell has a summer home and where he has been conducting many experiments, is a new one in women labor. Prof. Bell has started a boatbuilding plant and he has as far as possible employed women to do some of the work. In charge of the plant is Walter Pinaud, and under his supervision about fourteen young women and a number of men for the harder parts of the work and for instruction purposes are at work on dories and lifeboats which will be used by the navy. Already about fourteen of these boats have been completed and they have been tested and found to be up to the standard in every respect.

Columbus Was a Sticker

OCTOBER 12, long years ago, Columbus heaved a sigh, and pulled his boat on Yankee shore and landed high and dry—and so he got his name in print, we've read it forty times, in histr'y's prosy narrative, or else in jingling rhymes.

Columbus was a sticker, by heck he surely was, to put a kink ten inches through in all their sailin' laws.

Folks used to hold that if they sailed at some mad, killing pace, their tub some day would disappear and drop off into space—that big black men and wunks and things and wizzled witches, too, would pulverize the captain and feast upon the crew.

But old Chris C., he didn't give a rip for all their lore, so he hired a boat one sunny day and started to explore.

You know the story, course you do, of how the crew kicked up, and said he had a flattened head, and was a wall-eyed pup. They planned to hand to Chris a deal that was both cruel and raw—they'd kick his shin bones with their boots and whack him on the jaw.

But he kept sailin' straight ahead, chuck full of hope and trust—to find some new untaken place, or in the effort bust.

And when the thing looked just all in a sailor climbed a mast, and opened up his speaking tubes with one almighty blast—he'd seen some land right straight ahead, they'd hit it with a bump, and then they 'llowed that Christopher was not one all-fired chump.

It's been the same thing ever since, the man who don't get blue, but sticks right to his diggin' just like a hunk of glue—he gets there with both feet on top, in city or on farm—but there ain't much prospect for the man who crawls beneath the barn.—ARK.

Demand for Steel Still Away Beyond Capacity

Rather Serious Situation Developing—War Industries Calling For Steel in Greater Quantities Than Ever—Canadian Plants Are Going to Get More United States Shell Business

BUSINESS is going to be brisk in Canadian circles for some time to come if present indications are anything to go by. Dealers in the Dominion are purchasing again in large quantities. The renewal and placing of new business in Canada for the American government means that the munitions business is good for some time to come.

The developments of certain lines in Canada can proceed only along circumscribed lines at present. The real seriousness of the situation is not generally apparent. The War Industries Board of Washington is calling for steel at a rate that is startling. Right now the call is for five million more tons for first half 1919 than the present capacity of the furnaces and mills can show. Where the extra material is coming from is a question that is a very serious one for all concerns that look to U. S. production centres for their supplies. It means that restrictions placed upon the Canadian market will be strictly adhered to, and there will be a tendency to make these tighter than in the past.

Pittsburg reports indicate that it is almost useless to go to the mills armed with priority certificates and licenses and preferences. In fact all such documents look alike now. It is generally found that all the mills have plenty of customers who have been armed with similar documents, and the preferences, etc., are simply placed on the books together with plenty of other preferences just as good.

British Columbia is placing large orders in the East this week. Just a few days ago a purchaser representing three shipbuilding concerns on French orders was in Ontario placing orders for 12 boilers and 24 engines. He claimed that in this way he could secure much better terms and delivery dates than by the three companies going into the market individually with smaller orders. His total buying represented about three-quarters of a million dollars.

The scrap metal situation is more serious in United States than in Canada. A larger amount of scrap than usual is finding its way into foundry mixture. Some of the dealers are inclined to hold that there is plenty of material in the consumers' yards, and that the talk of a shortage is being kept up to keep shipments from being allowed to United States points, there having been an embargo against this for some time past.

IT IS SMALL USE TO GET ARMED WITH PREFERENCES OR PRIORITIES

Special to CANADIAN MACHINERY.

Pittsburgh, Pa., Sept. 5.—The very brief statement that was given out in New York to the press relative to last week's meeting in New York to consider conditions as to steel supply evidently does not begin to cover the proceedings. The meeting was attended by representatives of the War Industries Board, the producers of pig iron and steel and some consumers of steel. Evidently the situation is so delicate that publicity as to precise measures to be taken is not considered desirable.

The situation is that there is a wide gap between the steel requirements and the prospective output. The War Industries Board some two or three months ago estimated the steel requirements for the current half year at 20,000,000 net tons. Now it places the amount at not under 23,000,000 tons, and intimates that 25,000,000 tons might be more accurate. Furthermore it has furnished the steel makers such details of the items composing the total as to leave no doubt in the minds of the steel makers that the amount ought to be provided if at all possible.

On the other hand production will do moderately well if it exceeds 18,000,000 tons, and quite well if it reaches 19,000,000 or 20,000,000 tons. About 6,000,000 was produced in the past two hot months, and while a moderate increase is to be expected this month, and quite a heavy production in October, there are the usual dangers of curtailed output in the winter.

Steel for Offensive

The increase in the War Industries Board's estimate of total steel requirements shows that there have been additions to the list. As to the general character of these additions there is no uncertainty. They represent distinctly steel to be used in offensive warfare, and thus the increase in the total estimate can be linked directly with the remarkable change that occurred in July in the character of the operations on the western front, whereby Marshal Foch assumed not merely the offensive but the initiative, an attitude which has been continued with increasing vigor. The alignment is reflected in a very large increase in the shell steel requirements and in the demand for large numbers of rolling field kitchens. For the latter there has been a rapid canvas of the possibilities of furnishing merchant bars for axles and framework, sheets for bodies and tin plate for tinware equipment, besides many minor items in finished steel. There have been increases in the war steel demand along other lines, details not being given yet.

New Shell Steel Producers

Two important wire departments are to be converted for the rolling of shell rounds, chiefly 82 mm., a large part of the tonnage to go to French shell factories. These are the Donora works of the American Steel & Wire Company and the wire department of the Jones & Laughlin Steel Company's works at Aliquippa, both near Pittsburgh. The small billet mills in these departments, hitherto used to roll billets for the rod mills, are to be replaced by equipment for rolling large rounds. The rumored cost of the changes is so large as to suggest that some changes may be contemplated in the steel making departments at these plants.

All the additional shell steel that is to be rolled at various plants, however, does not represent a net addition to the shell steel supply, for the reason that at one rail mill at least the production of shell steel has had to be decreased in order to provide the larger tonnage of rails required. There is the 200,000 tons recently allotted for shipment to the A.E.F., and there is heavier rolling of rails on old orders of domestic roads. So much tonnage is due the domestic roads on their old contracts that little if any new buying will be required by domestic roads for this year.

Less Steel for Some Finishing Departments

The shutting off of wire production at the two wire plants just mentioned will hardly be made up by increased wire production at other plants, hence a net decrease in the production of wire is in prospect. Other decreases will likely occur. The production of merchant bars, which has probably ranged between 60 and 70 per cent. of capacity, is likely to come down, even though question has been raised whether the previous production has been sufficient to maintain important industries more or less helpful in winning the war. It is almost certain that in the not distant future the supply of sheet bars will be further restricted, but whether this will fall upon tin plate mills or upon sheet mills, or upon both, remains to be seen.

Of Very Little Value

With the wider gap between steel requirements and steel supply, a mere place upon the preference list is of relatively little value. Substantially all the war activities have their place, in order, upon the preference list, also all the commercial activities that have been recognized as contributing to the success of the country's war work. The priorities in favor of direct war material, first specifically granted in each instance, but lately made the subject of "automatic priority" by the buyer certifying the purpose, are, however, so heavy that they leave little steel for such purposes on the preference list as do not also have priorities. As to class D steel, which is steel that might be left after priorities and preferences were taken care of, that is practically forgotten. Many mills concluded long ago, by the way, that there was a sort of "catch" in this class D stetel, in that if they should apply for the required permit to ship steel as class D the application would be interpreted as an acknowledgement that the tonnage was actually to spare, and the War Industries Board would call for the steel for a required purpose instead of granting the permit sought.

Production

Attention has lately been focused upon the fact that some blast furnaces are not making their normal output by reason of coke shortage, and the Fuel Administration is insisting that the Railroad Administration furnish absolutely full transportation facilities for the movement of coal to by-product ovens. Of late several furnaces in the Chicago district have been forced to bank, their attendant by-product coke ovens not being fully supplied with coal. The weekly reports of coke production would seem to suggest that there ought to be an ample supply of coke for blast furnaces, but there must be a loose end somewhere, either a distribution to some purposes not so essential as pig iron manufacture, or a deficiency in quality requiring the use of too much coke per ton of pig iron. The furnaces in blast ought to be good for a production of 42,000,000 to 43,000,000 tons of pig iron a year, instead of the 40,000,000 to 41,000,000 tons actually being turned out.

POINTS IN WEEK'S MARKETING NOTES

Field kitchens of the mobile variety for the use of the allied armies on the west give some indication of the way the trend of the war affects the making of steel.

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Pittsburgh mills report that there is very little use having preferences and priorities, as the mills are clogged with orders all made up in this manner.

—

The Baldwin Locomotive Co. is out with a list looking for the purchase of 1,049 machine tools, probably the biggest single demand ever brought on the market.

—

The government demands in U. S. are so heavy for steel that no plans are being made to manufacture pleasure cars after January 1, 1919.

—

Scrap dealers in some cases hold the view that the talk of a shortage of scrap material in Canada is for the purpose of keeping up the embargoes against shipping material from this country across the border.

—

A purchasing agent from the coast representing three shipbuilding concerns, placed orders in the east this week for twelve boilers and twenty-four engines, the coast firms believing that they could buy to better advantage by pooling their business.

—

There is good reason to believe that shell contracts that expire about the end of September will be renewed, and that they will run well over the first half of 1919.

—

Dealers in machine tools in Canada believe that there will be many months yet of activity in the selling of machine tools for munitions work, as well as supplies.

—

The call for plate is greater than ever, and on this account the usual allotment of ingots for other lines is being curtailed to increase the rollings on plate.

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The War Industries Board of United States places its first half 1919 requirements of steel at almost 5,000 tons past the present capacity of the plants.

—

Steel output is recovering from the hot weather curtailments, but it will only be a matter of a few months, the trade fears, until the troubles of cold weather and poor transportation become prevalent.

SEE GOOD BUSINESS FOR MACHINE TOOLS

Renewal of Contracts Will Mean Steady Demand for Equipment in This Country

TORONTO, Sept. 5.

BUSINESS has been brisk in the machinery trade for several years in Canada. It is brisk right now, and from indications that can hardly be questioned or doubted it looks as though it would continue brisk for some months to come. There has been a large volume of trade moving apart from the equipping of plants for war work. Orders come in for odd lots from all parts of the country, and in the aggregate they amount to a big item. In some cases war contractors are adding a few extra tools to their equipment to get the best results, while in some cases domestic business finds it necessary to add to their plants. The trouble is that business in Canada that calls for a supply of steel is up against a stone wall in the matter of supply. There are all sorts of large contracts that are waiting patiently to get a chance at the allotment of steel that is made to Canada by the War Industries Board at Ottawa. Were it possible to get all the steel and iron required at the moment there would be an industrial development and expansion that would be startling, to put the case mildly.

The Call is for Plate

The call for plate is loud and insistent. In fact there seems to be a growing belief that everything that comes from the open hearths will have to be flattened out into ship plate or boiler material. There seems to be no possibility of the capacity of the rollers catching up to the demands that are being made on the output.

Dealers in this district are having some trouble satisfying the trade that their orders are getting the consideration due them. Priorities and ratings may be secured, but that is no sure indication that delivery will follow, because plenty of other concerns have been armed with just such documents, and the later orders are simply placed on the books to wait their turn.

Pooling Their Orders

Vancouver firms having orders for the French government are pooling their business, and this week a purchasing agent from the coast was in the east representing three of the companies that will handle twelve carrying boats on French order. He placed orders for twelve boilers and twenty-four engines, the business going to the Allis-Chalmers and GoldieMcCulloch for engines, and to the International Engineering Co. for a good part of the boiler work. The purchaser claimed that he was satisfied that by the pooling of orders in this way he had done much better than had the three firms in question gone out into the market and placed their orders individually.

Scrap Piling Up

Dealers in second hand material claim

that there is accumulating a large amount of material in the yards in the Dominion, and they also say that in some cases the larger users have a good supply on hand and are to all intents and purposes out of the market for some weeks. Users in many quarters, on the other hand, claim that they cannot get supplies necessary, but in many cases it will be found that these places are not on war work. Some of the dealers are inclined to claim that users of scrap keep up the reports of shortage of material in order to keep up the embargo on shipments from Canada across the border.

As a matter of fact domestic trade is rather slow because munitions business has first call on the scrap yards the same as it has any place else. On this account there are grades of second-hand materials that are not being called for to any great extent.

Machine Tool Business

Dealers in Toronto have met a large number of out-of-town users of machine tools and equipment during the week. A large number of sales have been made, although in some cases promises of delivery have of necessity been very vague. The advantage of dealers having their work well laid out and planned before they promise deliveries has been amply demonstrated several times during the past year. There are cases right now where contractors have received good deliveries, almost on time, while for other parts of their plant the delivery schedule is simply shot to pieces. The result is that no progress is being made.

The munitions business is being well handled now, and CANADIAN MACHINERY understands that contracts with shops that have been obtaining good results are going to be renewed. This refers especially to the 75 m.m. work, some first contracts for which expire about the end of September. In fact it is believed that arrangements are well under way for the carrying on of orders well in 1919. This means more business for machine tool dealers, for supply houses, in fact for all the various branches that have been influenced in their volume of business by the carrying on of the munitions business in Canada. There is a brisk demand for makers of machine tools to get out goods for the Canadian market, the dealers here being confident of their ability to handle almost anything that they can arrange for.

The situation here in many lines, as pointed out before, rests largely on the ability of U.S. production. The authorities at Washington have no small matter on their hand. Their desire is to bring output to as near the 100 per cent. standard as possible, and at the same time they are confronted with the necessity of meeting the calls of the draft for men at the front. Between the two there must be a fine adjustment, and one that will call for keen foresight and fearlessness. At the present moment the supply of coal is a big problem, as several large furnaces have been banked lately because the output of coke was not sufficient to keep them all in operation. In such a case the authorities simply direct the available supply to be turned to the plants making the materials most urgently needed at the moment.

WANT TO USE MORE SCRAP TO SAVE PIG IRON, BUT CANNOT SECURE SUPPLY

THE scrap metal situation, in a broad sense, is a peculiar one just now. In some cases the authorities in United States are urging the foundry interests to use larger amounts of scrap in their mixtures, with the idea of making the supply of pig iron go farther. These shops claim now, and apparently with good reason, that they would do so if they could get the scrap they require. There is a shortage of scrap in United States, while in Canada fairly large stocks are on hand. Reports from U. S. points are as follows:

Chicago: Rolling mills grades are in fairly good demand, otherwise there is a keen and a decided shortage. Heavy melting steel is not coming out in the usual volume, and users stand ready to make large purchases. Those who refuse to pay commissions are having more trouble in securing supplies than those who remunerate the dealers.

Pittsburgh: Demand for all grades of scrap continues strong. There is scarcely a large consumer who would not take heavy tonnages could they be secured. Heavy melting is much demanded as well as low phos. scrap, but machine shop turnings are also inquired after. Stocks in the yards of the dealers are not as large as they were a year ago, and dealers see no chance in many cases of making replacements. The labor situation is also a factor as yard men are scarce.

Cleveland: In ability to get sorters for the yards in some cases here has caused dealers to turn down business as they claim they would be doing the trade a poor service by sending out material at random.

Cincinnati: From all reports that come to this centre there is a shortage of scrap material that is unprecedented. Dealers state that they have not enough material coming in to fill orders and are constantly forced to draw on their reserves, while these reserves are being depleted at a very rapid rate.

St. Louis: Dealers here charge that the usual sources of supply for old material have been dried up, and there is nothing where big tonnages used to originate. Stocks of consumers have been sadly depleted and they are willing to buy anything they can secure at reasonable prices. The labor situation is described as the worst since the war, and it is becoming worse instead of showing the expected improvement.

New York: Offering supplies here in scrap are at a rather low point, and it looks are though they would remain in that condition for some time. Labor is scarce and material moves slowly through the yards.

Philadelphia: The trade here has come across several cases where foundymen have been requested to use a larger proportion of scrap in their mixture to ease up on the iron situation. They can't do it because the scrap necessary for such a movement is not available.

PRODUCTION OF PIG IRON DOES NOT GROW FAST ENOUGH TO MEET NEED

THE production of pig iron seems to have reached a point past which it is hard to force it, according to reports from United States producing centres. There is a shortage of coke because there is not enough coal coming to the ovens. Steps are being taken to remedy this, but it is not an easy matter, as it comes largely to a question of man-power, and both the army and the industrial world are now calling for the men most fitted to do this class of work. Reports from some of the larger United States points show the following:

Chicago: The total sales made for 1919 delivery are not large. In fact they are small. There is no encouragement to tieing up for next year delivery.

New York: One maker of pig iron made inquiry of the War Board regarding the taking on of 1919 business, and was advised that such a course could not possibly be sanctioned. The result is that his output is to be left entirely to the allocation of the authorities at Washington. The belief is growing that some non-essential users of pig iron will be eliminated or severely curtailed, and that there will be enough iron only to take care of the shops that are working on government-sanctioned orders.

Buffalo: Shortage of coke is hampering a few of the producers in this district. It is a generally understood thing now that it is not much use approaching the mills for 1919 bookings, as they are quite content to let the bookings take place after the allotment has been made by the government authorities.

Cleveland: One of the large furnaces here that has been changed over to basic will be turned back to foundry iron for a short period to provide relief for some of the users who have been almost shut off from a supply for necessary work. The British Government has a large order for basic in this district and it will have to wait for a few days until relief is secured for the foundrymen.

St. Louis: Interests hereabouts have

had men in New York and Washington to canvass the situation, and they report that there is going to be no surplus of pig iron. The demands for domestic work are simply colossal, but there is not even a remote chance of any of these being considered for some time to come.

Philadelphia: The discussion of costs and the fixing of values for the fourth quarter are interesting the men in the trade here just now. It had been planned to bring in a large tonnage of low phosphorus iron from Spain. This would have relieved the situation, but the question of bottoms had not been fully reckoned with. It is impossible for the present to get shipment from Spain, and the plan has been for the time being abandoned.

Pittsburgh: Some of the pig iron makers here, discussing prices for the fourth quarter, claim that higher rates should be paid, owing to the increased costs from labor charges and transportation. They state that their earnings have been whittled down to a fine point. Although the weather has improved for furnace and rolling mill work, there has not been a decided gain in production figures owing to a shortage of coke. This is the first time in many months that production in this district has been interfered with on this account.

CUTTING OFF THE PLEASURE AUTOS

U. S. Government In Market for All the Steel There Is In Sight At Present

Special to CANADIAN MACHINERY.

New York, Sept. 4.—The Baldwin Locomotive Co. has come into the market for several million dollars worth of machinery to be installed in plant which it is building at Chicago, reference to which was made in this report about the middle of July. The list just issued calls for 1,049 tools, being the largest single inquiry ever placed before the machine tool industry in this country. Inquiries for cranes, also to be installed in this plant, are expected to be put out soon. Other manufacturers of railroad motive power are expected to come into the market in the near future. The Davenport Locomotive Co. has just purchased $30,000 worth of tools in the Chicago market.

Several railroads that put out inquiries some weeks ago have now made purchases of machine tools, including the Monon and the Rock Island; the St. Paul and Sante Fe are also in the market. The Elgin, Joliet & Eastern has closed bids on a large lot of shop equipment. The Pennsylvania, the Erie and the Central of New Jersey are about to place orders for cranes.

In the last few days, interest in the machinery trade has been centered in the placing of large Government orders for motors for airplanes and tractors; several of the companies that have received such contracts have been buying machine tools. These orders are of significance because they have immediately followed the unfavorable report of the Sub-committee of Military Affairs concerning the airplane program of the Government. The Willys-Overland Co., Toledo, has just received a contract for 5,000 Liberty airplane motors and for 3,000 tractor motors of 12 and 8 cylinders.

The Locomobile Co., of Bridgeport, which is making Liberty tank motors, has completed purchases of tools for the equipment of its new shop. This company has also taken over the motor contracts of the Trego Motor Corp. of New Haven. The Pierce-Arrow Motor Car Co., which is making Hispano-Suiza motors, has made additional purchases of tools to carry out its contract. The Union Switch & Signal Co., Pittsburg, to increase its output of Lerhone Airplane motors, is buying additional shop equipment. The H. H. Franklin Manufacturing Co., Syracuse, is purchasing additional machine tools to manufacture motor crank shafts for the Wright-Martin Aircraft Corp.

Using Automobile Shops.

Government contracts for airplane motors in large quantity and for motor parts to be used in repair work are expected almost immediately. The intention is to utilize as much of the capacity of the automobile shops as is possible. The heavy Government demand for steel will leave so little metal available for making passenger automobiles that no plans for making pleasure cars after Jan. 1st, 1919, are being made. The Velie Motor Vehicle Co., Moline, Ill., has received a Government order for tractors. The Ford Motor Co., Detroit, is to make a large number of "whippets" or small tanks for military service in France. Another Detroit automobile maker is already manufacturing large fighting tanks. The Willys-Overland Co. is manufacturing shells and gun carriages as well as motors for the Government.

Several Government departments have pooled their locomotive crane requirements for a year, the Crane Section of the War Industries Board having allocated orders for 600 cranes of such type for the War and Navy Depts., for the Director of Military Railways, for the Railroad Administration and for the Emergency Fleet Corp. The capacity of the plants manufacturing locomotive cranes, which amounts to 108 cranes a month, has been absorbed for six months. As a result of these large Government orders, delivery dates on other contracts for locomotive cranes have been postponed until next March.

Water-power engineering has suffered in the past from an unfortunate concatenation of circumstances which have led to its comparative neglect. Great Britain is the home of inventive genius and of mechanical skill, and consequently the trend of engineering development all over the world has been largely along the lines dictated by British conditions. There is no generator of energy which is more efficient than the water turbine properly designed; there is probably no more wasteful device than a steam boiler and engine. There is waste from start to finish; much of the heat of the coal passes away through the chimney, more is lost by conduction and radiation from the steam in boiler and pipes, and still more, in fact the greater part, is wastefully expelled with the exhaust from the engine. But the engineer found to hand a great store of coal, and natural water power is comparatively absent, so the generation of power from the combustion of coal or other fuels has received the greater part of his attention.

CAPTAIN JOSEPH O. GRAY

Capt. Joseph Osteers Gray has been appointed shipping master for the port of Montreal. Capt. Gray is well known in Montreal as the founder of a pioneer school of navigation and seamanship.

CAPTAIN J. MURRAY WATTS.

J. Murray Watts, naval architect and engineer, of Philadelphia, has been commissioned captain in the 57h Engineers (Inland Waterways).

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.

	C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	125 00	125 00
Spelter	11 00	11 00
Lead	10 50	10 00
Antimony	15 50	18 00
Aluminum	50 00	58 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 36

Standard Buttweld

Per 100 feet

	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	29 97	36 45
2½ in.	45 05	55 28
3 in.	58 91	72 29
3½ in.	73 60	91 54
4 in.	87 20	108 45
4½ in.	99 06	123 82
5 in.	115 40	144 30
6 in.	149 80	187 20
7 in.	195 20	243 95
8L in.	205 00	256 25
8 in.	236 20	295 20
9 in.	282 90	353 25
10L in.	262 40	328 00
10 in.	337 80	422 30

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	25 50	24 50
Copper, heavy	25 50	24 50
Copper, wire	24 50	25 00
No. 1 machine composition	23 00	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	26 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs	9 00	8 50
Cast borings	12 00	12 00
Stove plate	26 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	8 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 ... add	20
Machine screws, o. and fil. hd., brass ... add	25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ... plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws ... list plus	20
Collar screws ... list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ... add 40,	10
Cold pressed nuts to 1½ in. ... add	$4 50
Cold pressed nuts over 1½ in. .. add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XX. No. 11 September 12, 1918

Uses of Compressed Air in the Modern Shop

Least Possible Amount of Clearance, Efficient Cooling of the Air Cylinders and Rapid Action of the Valves Are Points That Come Largely Into the Question of Efficiency in Operation

By P. C. FRANK

FIG. 2—ENGLISH PNEUMATIC TOOLS IN SERVICE CHIPPING RAIROAD TIRES AT THE BOLTON IRON AND STEEL PLANT.

IN the modern shop the pneumatic tool is almost universally used and the air compressor whether operated by the electric motor, by gasoline or other internal combustion engines or by the steam engine or steam turbine, is now considered practically indispensable. The accompanying illustrations Figs. 1 and 2 show the use of pneumatic hammers at work on English castings and pneumatic tools in service chipping railway tires at the Bolton Iron and Steel Plant, at Bolton, England, the Boyer hammers noted in use having been supplied by the Consolidated Pneumatic Tool Co., Ltd., of Westminster, London, England.

The drawings Fig. 3, 4, 5 and 6 show the air compressors of the single simple stage types, and series of intercooling types, belt, rope, motor or steam driven with electric pneumatic control as developed by Isaac Storey & Sons, Ltd., at Manchester, England.

These engineers point out that the history of modern air compressors has followed in line with that of the steam engine, the old compressors and steam engines being made with a very long stroke and running at a moderate speed, modern ones with a shorter stroke and higher speed. The development in the direction of a much higher speed of revolution has been very much assisted, in the case of the air compressor, by the numerous electric installations which have been put in, a compressor running at a high speed being eminently suitable for driving by electric motor. The vital constructional points, according to these English engineers, for a compressor which shall give the highest efficiency include the least possible amount of clearance, efficient cooling of the air cylinders, efficient intercooling, and rapid action of the valves.

As to cooling and intercooling it is pointed out that, during compression, heat is generated, and that some method must be employed to cool the heated air, and thus ensure that the air is maintained at its greatest possible density during compression. The only practicable method of withdrawing the heat, and that generally adopted, is to water-cool the cylinder and its ends, and to employ intercoolers, through which the air is directed in its passage from one cylinder to the other.

It is claimed by these English engineers that the system of cooling in the Scott compressor presents great advantages, and is more efficient than that of the many types of jacket-cooled compressors These latter types rely solely on water jackets or chambers of small capacity cast on the cylinder or cover, and, owing to the various ribs, inlet and outlet ports,

FIG. 1—PNEUMATIC HAMMERS AT WORK IN AN ENGLISH SHOP.

joints and branches, the water space is broken up into a number of pockets containing only a small volume of water in each, thus greatly reducing the effective cooling surface and efficiency.

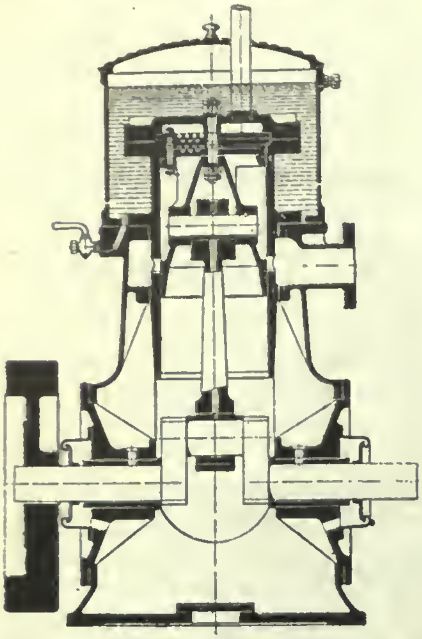
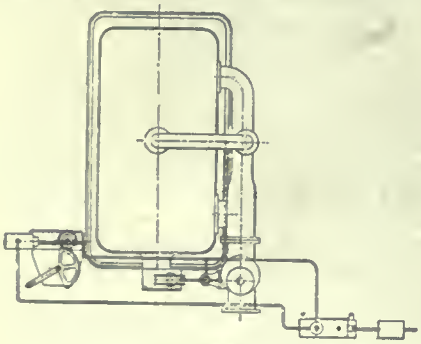


FIG. 3—ENGLISH SINGLE CRANK AIR COMPRESSOR DEVELOPED AT MANCHESTER AT THE PLANT OF ISAAC STOREY & SONS, LTD.

In the English compressor, noted in the drawings, a far greater cooling efficiency is obtained by the arrangement of totally immersed air cylinders, which, owing to the fact that they have no large piston valve or other chambers cast on, are perfectly cylindrical, and lend themse



PNEUMATIC ELECTRIC CONTROL

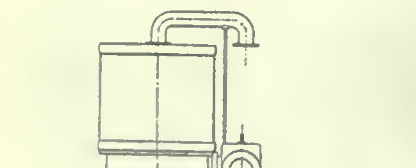


FIG. 5 ENGLISH COMPRESSOR CONTROLLING DEVICE.

peculiarly to this system of cooling. The cylinders and intercoolers are completely surrounded by a steel tank through which a large volume of water is circulated, the connections for this purpose being made in the frame and not in the tank, so that the tank can be lifted off without disturbing any of them, and the whole of the joints and surfaces of the cylinders and intercoolers are then exposed to view.

It will be seen that as usual the air after being compressed in the low pressure cylinders, passes through intercoolers to the high pressure cylinder, These intercoolers consist of a set of brass tubes expanded into tube plates in the ordinary way. The air is however passed through the tubes, instead of being passed outside, as usual, while the intercoolers are immersed in the cooling tank. The result is that the air is divided up into a number of small streams, so that this form of intercooling is much more efficient than any other method. In ad-

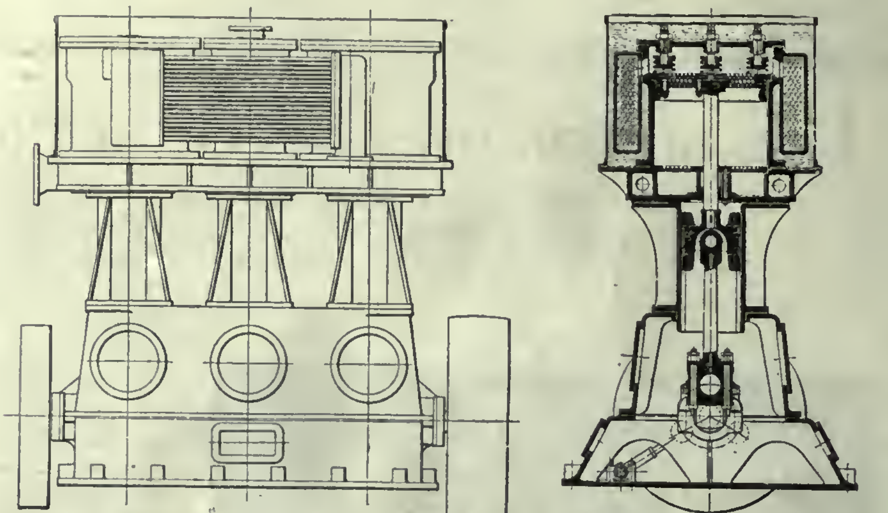


FIG. 4—SCOTT INTERCOOLER COMPRESSOR DEVELOPED AT STOREY WORKS, MANCHESTER.

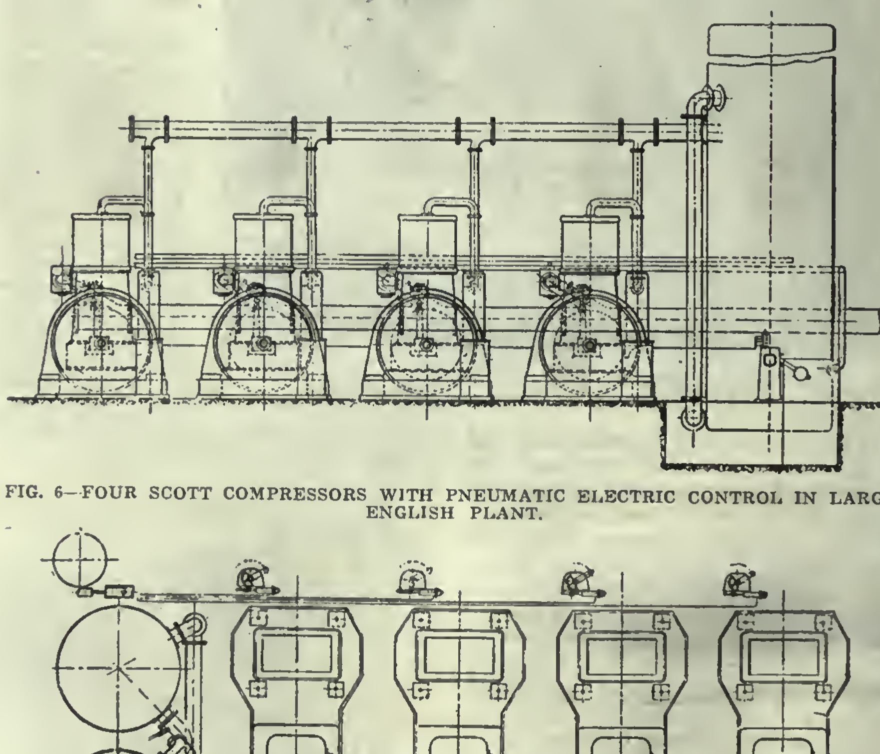


FIG. 6—FOUR SCOTT COMPRESSORS WITH PNEUMATIC ELECTRIC CONTROL IN LARGE ENGLISH PLANT.

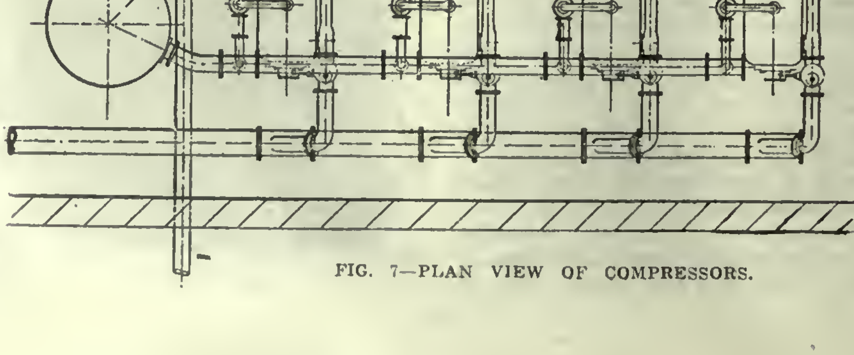


FIG. 7—PLAN VIEW OF COMPRESSORS.

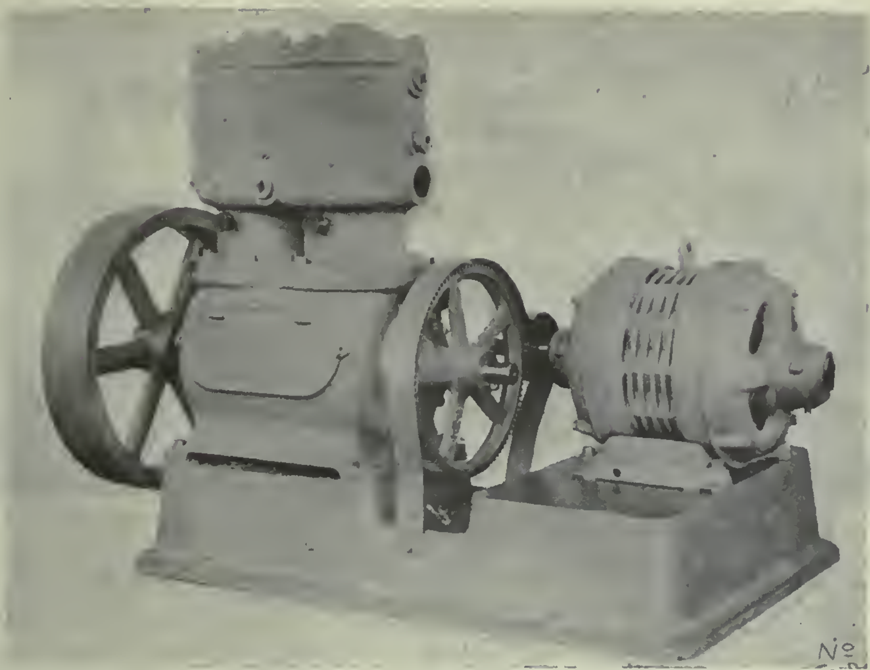


FIG. 8—AN AMERICAN MOTOR DRIVEN AIR COMPRESSOR

dition, the formation of air pockets in the intercoolers, which has given so much trouble with many compressors, is entirely obviated. A further advantage is that practically any water can be used for cooling purposes, as the arrangement is such that any deposit on the surface can be easily removed, while the presence of the large and freely moving body of water in the tank keeps down the water temperature, in consequenceof which the amount of deposit is not nearly so great. the automatic devices for unloading and governing the supply of air are provided in accordance with the particular installation.

The drawing Fig. 3 shows the simple single stage Scott compressor which consists of a frame and bedplate similar to an ordinary high speed engine), provided with bearings for one or two cranks according to the particular size of compressor. The top of the frame has the inlet air passage cast in it and the compressor cylinders, provided with inlet ports around the circumference, are fixed in bored holes in the frame, and each is fitted with a trunk piston worked by a connecting rod from the crankshaft, the annular part of this trunk piston being in constant communication with the inlet holes.

It is held that the form of the valve plates and the very small lift of the valves required to give full area make it possible for the clearance spaces to be reduced to an extent impossible with any other design. There are no valve pockets or ports, and the cylinder clearance can be so small that the piston and valve plates practically touch. The only parts requiring lubrication are the crankshoft bearings, the connecting rods, and the trunk piston and cylinder walls, and all these are lubricated by splash lubrication in the enclosed crank chamber.

The lower end of the truck is fitted with rings to prevent the lubricant being drawn in with the air. By means of oil throwers, fitted at each end of the crankshaft, any oil which has worked through the bearings to the ends of the shaft is flung by centrifugal force on to the inner walls of the oil catchers which are fitted on the end covers. The covers are provided with an oil drain at the lower side of the oil catcher, and the oil is thereby free to drain back into the crank chamber. By these means, ample lubrication is ensured, with satisfactory continuous running and extreme cleanliness.

The totally immersed system of cooling is effected by extending the casing sufficiently high to allow the water to cover completely the topmost part of the cylinder or cylinders. The top of the body casing is machined, and a removable water jacket is provided for this purpose. By this means the whole of the air cylinder and cover is completely immersed in a large body of cold water, thus ensuring that the air is kept as cool and consequently as dense as possible during compression. By draining off the water and removing the jacket the cylinder joints can be easily examined, as all pipe connections are made in the body casing and not in the jacket.

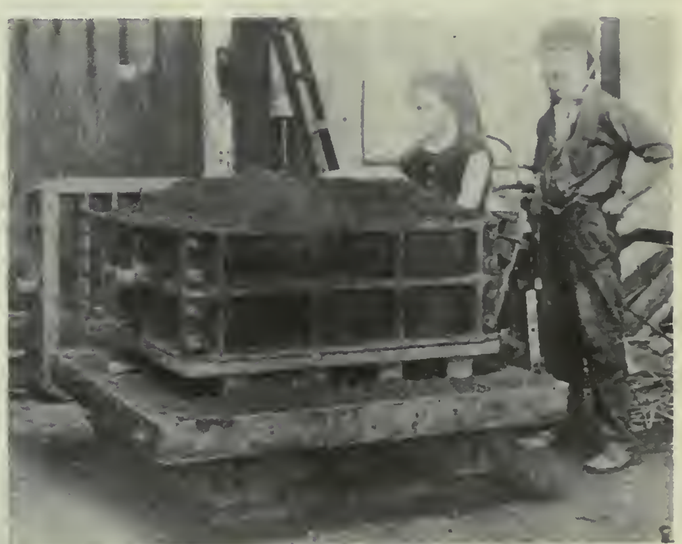


FIG. 9—AMERICAN PNEUMATIC MOULDING MACHINE DEVELOPED AT ZENLENOPLE, PA.

It is claimed by these English engineers that in compressors running at a high speed, the valves, generally, are the weak point and in this compressor the introduction of ball valves has given the simplest and most durable type of valve possible and they do not hammer their seats away. It will be readily understood that owing to the fact that each valve weighs but a fraction of an ounce, and has only a small lift, the impact on closing is extremely small, the wear being almost

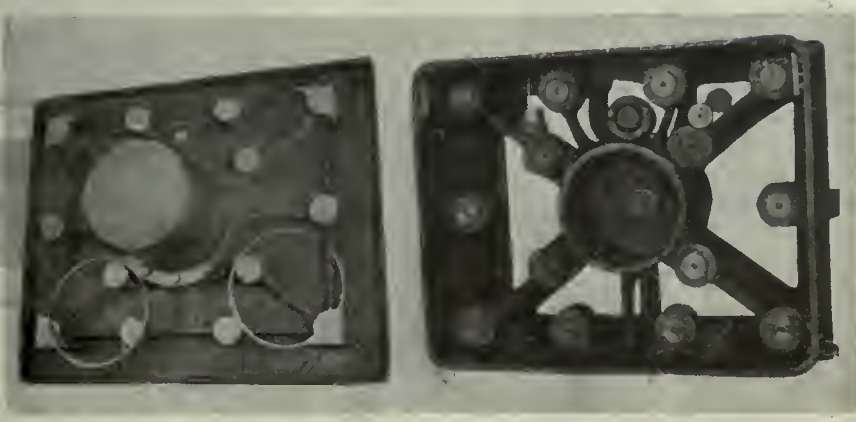


FIG. 11—THE HERMAN PNEUMATIC MOULDING MACHINES DEVELOPED AT ZENLENOPLE, PA.

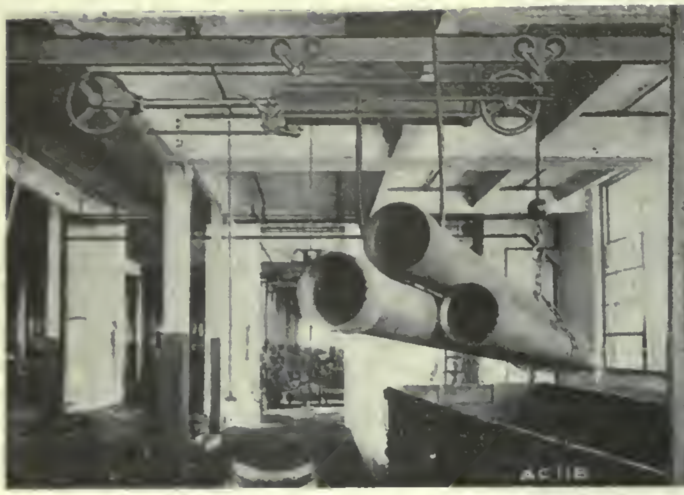


FIG. 13—CURTIS PNEUMATIC CRANE IN PIPE PLANT.

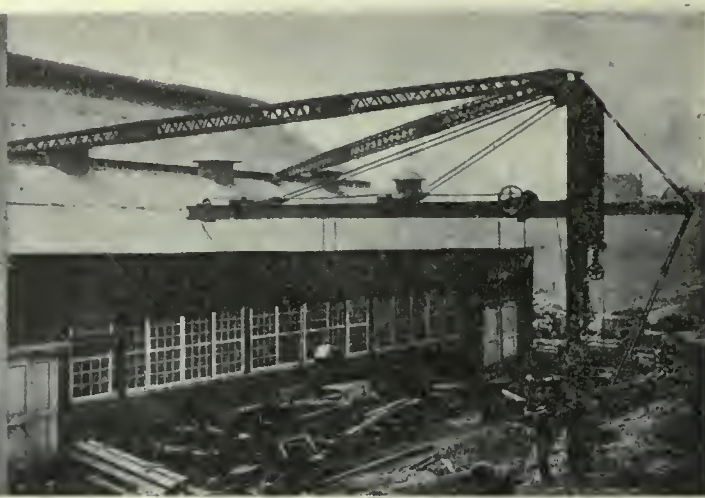


FIG. 14—PNEUMATIC SHOP YARD HOIST IN SERVICE.

negligible. This is proved by the fact that many of these valves have worked continuously for considerable periods without showing any appreciable signs of wear. A further advantage is the lightness of the valves enabling high speeds to be attained with silent running.

The valves, which are a special feature design, are in the form of hardened ground steel balls of small diameter, each working on a recessed drilled seating made from hard steel plates. The bottom plate is drilled with a series of holes of two diameters, the top portion slightly larger than the ball, and the lower portion smaller in diameter than the ball. This forms a pocket, in which the ball works, and a seat for it to rest on. The upper plate is drilled to the same templet as the lower one, and is then fixed so that the holes in it come half way over the holes in the lower one, the solid bars between the holes in the upper plate coming directly over the centre of the balls in the lower plate, and so forming a stop for the lift of the valves. Both the delivery and suction valves and plates are made exactly alike and can be easily examined or changed when necessary.

It will be seen that the upper side of the piston is fitted with a set of plates and ball valves, the air to the cylinders being admitted to these valves on the suction or down stroke. The position and rapid opening of the valves is automatically ensured by the inertia of the balls at the commencement of the downward or suction stroke. It will be observed that at the end of the compression stroke, when the piston commences its suction or down stroke, the rapid movement of the piston causes the inertia of the balls to pull them quickly off their seats, and thus opens the valves at the precise moment desired. At the lower end of the stroke, the momentum of the balls instantly closes the valves immediately in the commencement of the compression or up stroke, which is exactly what is required.

It will thus be seen that a very large area through the valve plate is obtained with an extremely small lift, which is, in fact only about 1-16". This gives a high efficiency, and results in extremely durable valves and seats, without the use of either springs or other complicated devices. Owing to the large outlet ports and valve chambers in nearly all piston or disc valve types of compressors the clearance spaces are extremely large with the result that the efficiency is considerably reduced.

In this English compressor there are no valve ports or chambers and owing to the unique design of the ball valves, large clearance spaces are entirely obviated, and the cylinder clearance can be so small that the piston and valve plates practically touch, thus ensuring the highest possible efficiency. It is almost impossible to wear out the ball valves or seats, as the balls work round and keep themselves absolutely tight for any length of time, and further there is no liability to fracture or any other damage, so common in the valves of many other types of compressors. There are no

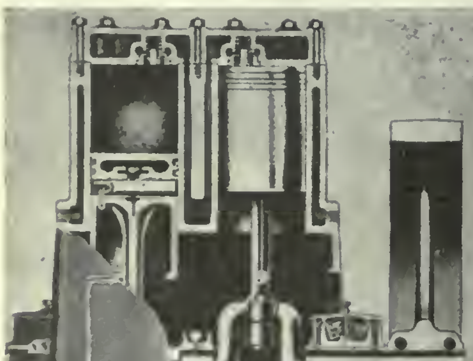


FIG. 16 DOUBLE CYLINDER CURTIS AIR COMPRESSOR.

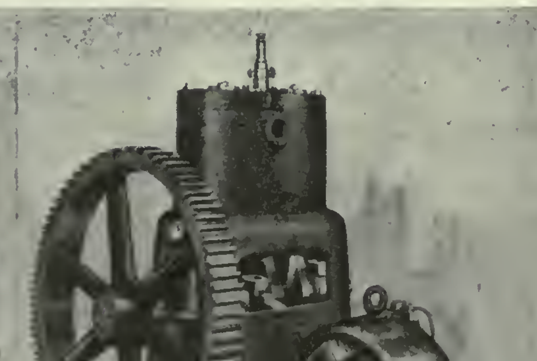


FIG. 18—ELECTRIC AIR COMPRESSOR WITH DRIVE GEAR.

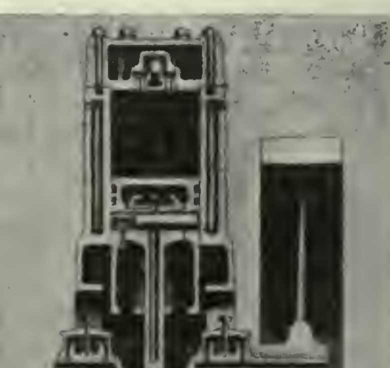


FIG. 15—CURTIS SINGLE CYLINDER AIR COMPRESSOR.

springs used in connection with the ball valves. Such springs, necessary in nearly all compressors, are a serious cause of trouble through their constant failure from fatigue, which often results in considerable delay, expense and annoyance before renewals are completed.

The drawing Fig. 4 shows one of these English intercooling compressors, designed for large capacity owing to its

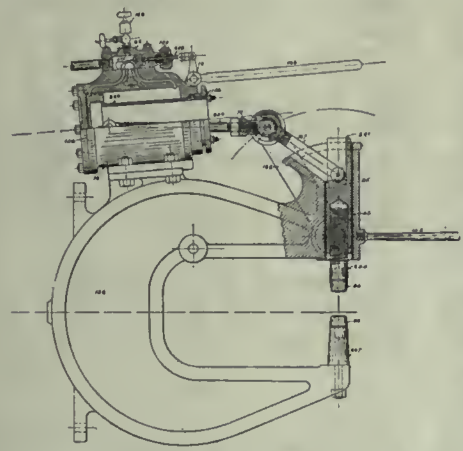


FIG. 19—A PORTABLE PNEUMATIC RIVETER FOR STRUCTURAL, BRIDGE AND RAIROAD WORK AND BOILER AND TANK CONSTRUCTION.

extreme regularity of turning, due to the correct equalizing of the pressure relations in the three cylinders. Especially is this so in the case of electrically driven machines, where the advantages due to this equal torque are very great, when the questions of the life of the motor and steady, continuous running over long periods are considered. It will be seen that the three cylinders are mounted on distance pieces and body casing similar to those of a high speed engine. Two of these cylinders act as low pressure and one as high pressure, the arrangement being that by these means an equal division of power is obtained between the three cranks, and a much cooler delivery of air in consequence of the proportioning of the compressions between the high and low pressure cylinders.

The delivery valve plate, which is designed to secure a minimum clearance, is held down by strong springs from the outer cover. These springs act as a safeguard in case the connecting rod wears loose and the piston strikes the delivery valve plate, which, it will be seen, is recessed into the upper part of the barrel and forms the top end of the cylinder. With this safeguard it is thus possible to work the compressors with such a minute clearance as 1-32 of an inch.

The drawing Fig. 5 shows the controlling device on the compressor which consists of a centrifugal governor combined with throttle valve on the inlet and an air pressure cylinder, and is arranged so that the compressor continues unloaded until it is within 10 per cent. of its full speed. When the pressure of air exceeds a fixed amount, the air cylinder acts on the throttle valve and again unloads the compressor. The combination of these two arrangements results in a control which enables a compressor to be unloaded, and therefore to be started without injury to the motor, and which also cuts off the supply of air when the pressure arrives at a desired point.

The control for starting and stopping the motor consists of a main air pressure cylinder with a number of units in the plant, which are run in series, and a control cylinder on each switch. These control cylinders are of the differential type, the small end being in constant communication with the air pressure main. The larger end communicates with the reservoir, and is filled with liquid from the reservoir to the cylinder, being controlled by adjustable valves. Air is admitted to the reservoir from the corresponding holes in the main air pressure cylinder previously mentioned. The regulating valves between the reservoir and the cylinder are so arranged that the speed of movement of the switch in the two directions can be varied independently and at will, and in the ordinary way this control is set so that the switch is thrown out of operation in 5 seconds and put into operation in 40 seconds, but this can be varied to any reasonable extent at will. This system of control contains no complicated parts, and is easily understood and kept in order by an ordinary mechanic, and it is perfectly certain in its action.

The drawing Fig. 6 shows an installation of four of these large English compressors working together in a large shipyard in the North. The compressors come into action one after another, as the pressure falls, due to the requirements of the service, and they go out of action in the same manner.

In American foundries, shops and quarries, the pneumatic tool and the air compressor are almost universally employed. The accompanying illustrations, Figs. 9, 10, 11 show the compressed air jarring machine developed at Zelienople, Pa., by the Herman Pneumatic Machine Co. The Herman jarring molding machine depends on the use of the compressed air for the perfect jarring of any cope and drag successfully in the foundry. The base and the table plate is of one size, and at different points in the base pockets are machined out, in which are placed rubber discs and on top of them steel discs. The table plate is of cast steel construction and blocks are cast at points, so when the table plate drops, strike on the different jarring blocks in the base. Guides are cast in the table plate and in the corners of the base guides plates are placed. These relieve the wear on the cylinder and it is impossible to get a load off centre so that the cylinder or the plunger is in no way affected. It is claimed that in this works and in these machines the pneumatic jarring principle was first used for molding machines.

In the many American machine shops and foundries and factories, pneumatic elevators and hoists are utilized to advantage also in the yards for handling the raw material and finished product as indicated in photographs, Figs. 12, 13 and 14. In the accompanying illustrations, Figs. 15, 16, 17 and 18 may be noted the details of construction of the Curtis air compressors and of the electrically operated air compressors with belt and gear drive developed at St. Louis, Mo., by the Curtis Pneumatic Machinery Co.

These electric air compressors are full self-oiling with controlled splash and regulatable sight feed cylinder lubrication. It is claimed that they have 80% more cooling surface than any double-acting compressor of the same capacity and the heads and valves being water-cooled as well as the cylinder walls increase the volumetric efficiency. The machines are self-contained, considerably heavier than other compressors of similar capacity, assuring freedom from vibration, admitting of light foundations and withstanding the excessive strains due to speed and high pressure. The automatic unloader makes this compressor especially economical and desirable for intermittent service. The controlled splash oiling system with its regulatable sight feed of the oil fed to the cylinder, its consequent saving in oil and attention is another feature found only in the Curtis compressor. The discharge for the water circulation is taken from the heads or in other words at the highest point of circulation, so that there is never any possibility of the hot water becoming pocketed or trapped in the heads, and there is no possibility of water circulating without passing through the heads.

FIG. 20—THE CLARK AIR METER DESIGNED AT DENVER, COLORADO, TO ACCURATELY MEASURE THE FLOW OF AIR.

How Hun Plotters Worked in Canada Early in War

Dastardly Attempts to Destroy Property and Prevent Canadians From Reaching the Front—How United States Kept in Touch With the Plotters and Spoiled Their Plans at Every Turn

By EARL E. SPERRY and WILLIS WEST for U. S. Committee on Public Information

THE second chief purpose of the German Ambassador and his lieutenants in America was to prevent Canada from giving military aid to England. That this enterprise was carried on at the command of the German General Staff is indicated by the following telegrams sent in January, 1916, to Count von Bernstorff:

Jan. 3 (Secret.) General staff desires energetic action in regard to proposed destruction of Canadian Pacific Railway at several points with a view to complete and protracted interruption of traffic. Captain Boehm, who is known on your side and shortly returning, has been given instructions. Inform the Military Attache and provide the necessary funds.

(Signed) ZIMMERMANN.

Jan. 26. For Military Attache. You can obtain particulars as to persons suitable for carrying on sabotage in the United States and Canada from the following persons: (1) Joseph McGarrity, Philadelphia, Penn. (2) John P. Keating, Michigan Ave., Chicago. (3) Jeremiah O'Leary, 16 Park Row, New York. One and two are absolutely reliable and discreet. No. 3 is reliable, but not always discreet. These persons were indicated by Sir Roger Casement. In the United States sabotage can be carried out on every kind of factory for supplying munitions of war. Railway embankments and bridges must not be touched. Embassy must in no circumstances be compromised. Similar precautions must be taken in regard to Irish pro-German propaganda.

(Signed)
REPRESENTATIVE OF GENERAL STAFF

The Start Of It

The earliest attempt to carry out these plans of the German General Staff was made by Horst von der Goltz, a German citizen who came to the United States from Mexico. In an affidavit he thus describes the origin and purposes of this project:

Shortly after my arrival at New York (from Mexico), I received a letter signed by Dr. Kraske, Vice-Consul at the German Consulate in New York, requesting me to attend at the consulate at a certain hour, in order that I might meet a gentleman who was interested in me. The letter was a mere matter of form, intended to inform me of the hour of a meeting proposed to me by Capt. von Papen.

Attending to this request I had at first some conversation with Capt. von Papen concerning events in Mexico, and afterwards was asked to give my opinion about a proposal made in a letter to the German Embassy, the writer of which asked for financial support, in order to carry out a scheme by which he wrote he would be able to make raids on towns situated on the Canadian coast of the Great Lakes.

The proposal being rejected on account of the Embassy receiving unfavorable information about the writer, I was first requested to give my assistance to a scheme of invasion intended to be put in execution by seizing some spot on the west coast of Canada with the assistance of German warships. Reservists from the United States were to be sent to another neutral country, where they were to be embarked. Such a step it was supposed would:

(1) Prevent the Canadian contingents then under training from sailing for Europe.
(2) Prevent Canada from supplying England with necessaries on account of their being needed in the country itself.
(3) Bring matters in the United States to a decision, the Government being forced either to supply both parties with arms and ammunition, or to prohibit the export of those articles altogether.

This scheme, proposed by Capt. von Papen and supported by Capt. Boy-Ed, was abandoned, objections having been made by Count Bernstorff.

Then two Irishmen, leaders of Irish associations, who both had fought during the Irish rebellion, proposed the wholesale blowing up of the canals connecting the Great Lakes, main railway junctions and grain elevators. It was alleged that by these means, as well as by wholesale distribution of proclamations intended to terrify the populace, combined with rumors of invasion judiciously circulated in the press, a panic would be created in Canada which would prevent the Dominion from giving any aid to England.

I was ordered to put this scheme in execution.

The Welland Canal

After these plans had been discussed at the German Consulate and at the German Club in New York City, it was decided that von der Goltz should attempt to blow up the Welland Canal, the grain elevators at Fort William, and, if possible, the Sault Ste. Marie locks and railroad bridges. Capt. von Papen supplied him at the German Club with the needed fuses, wire, and generators, and referred him for dynamite to Capt. Hans Tauscher, American agent for Krupp and other German makers of munitions. Von der Goltz told Tauscher about the plan to blow up the Welland Canal and received from him the following order for dynamite:

New York, Sept. 5, 1914.
E. I. du Pont de Nemours Powder Co.,
90 West Street, New York City.

Gentlemen:—Referring to my telephone conversation of yesterday, with your Mr. Clark, will you please deliver to bearer, Mr. Bridgman Taylor (a name assumed by von der Goltz), the three hundred (300) pounds sixty per cent. (60%) dynamite and send invoice to my above address for payment after delivery.

Yours very truly,
H. TAUSCHER.

The bill for dynamite which von der Goltz took with him to Buffalo and the receipts for money which he had received from Captain von Papen prior to his departure here follow:

E. I. du Pont de Nemours Powder Co.,
New York City, Sept. 11, 1914.
To H. Tauscher, 320 Broadway.
200 lbs. du Pont straight 60%.....$31.00

New York, 25 August.
I acknowledge the receipt of One Hundred Dollars.
HORST v. d. GOLTZ.

Imperial German Embassy,
Military Attache.
New York, Sept. 7, 1914.
I acknowledge the receipt of Six Hundred Dollars (expenses, of which two hundred dollars was in the form of a check on the Riggs National Bank at Washington).
H. V. D. GOLTZ.

The Plot Failed

Von der Goltz then went to Buffalo on the New York Central railroad with two suit cases containing about one hundred pounds of dynamite, but was unable to carry out his plans, because John Ryan, a Buffalo lawyer, did not give him the telegraphic instructions which von Papen had sent.

The conclusion of the expedition is marked by the following telegram sent by von Papen under an assumed name:

September 24, 1914.
John T. Ryan, Buffalo:
Please instruct Taylor cannot do anything more for him.
STEFFENS.

Captain von Papen promised to arrange with Ambassador von Bernstorff for von der Goltz' departure, and the following receipt shows what the arrangement was:

New York, October 1, 1914.
I acknowledge the receipt of \$150.00 with the obligation of using the amount for a voyage to Germany.
(Berlin General Staff.)
H. von der GOLTZ.

The following counterfoils in von Papen's checkbook show these records concerning expenditures for the expedition against the Welland Canal:

Sept. 1 (1914). Bridgman Taylor...\$200
Sept. 16. Taylor, Ryan, Buffalo..... 200
Sept. 22. Ryan, Buffalo 200
Oct. 14. "Fur Fritzen, Busse, Buffalo" 40

Receipts bearing the signature of von der Goltz show that in addition to the sums above mentioned he also received \$1,050.

With his confederates, Tauscher, von Papen, von Igel, Fritzen, Tuchendler, and Covani, he was indicted for conspiracy to set on foot a military enterprise against Great Britain. Von Papen and Boy-Ed, being attached to the German Embassy, were recalled by Germany on December 10, 1915, as the result of requests made by our Department of State. Von Igel returned to Germany with Ambassador Bernstorff in February, 1917, forfeiting his bond. Tauscher was acquitted, the jury appearing to believe his statement that he did not know the intended use of the dynamite which he assisted von der Goltz to procure. Fritzen has not been tried, having pleaded guilty to another indictment on which he was sentenced to eighteen months in prison, where he now is.

Another Attempt

Another attempt to blow up the Welland Canal was made in September, 1915, by Paul Koenig, head of the Bureau of Investigation of the Hamburg-American Line. This Bureau, increased in number after the war began, and operating from the offices of the steamship company at 45 Broadway, became the most dangerous sub-center of criminal intrigue maintained in America by the German Government. Among Koenig's papers is one entitled "History of the Bureau of Investigation," and under the year 1914 occurs this entry.

Aug. 22. German Government, with consent of Dr. Buenz, entrusted men with the handling of certain investigation. Military Attache von Papen called at my office later and explained the nature of the work expected. (Beginning of Bureau's services for Imperial German Government.

The measures adopted by Koenig to serve the German Government by blowing up the Welland Canal were thus described in a sworn statement made by George F. Fuchs, a member of the secret service division of the Hamburg-American Line, with whom Koenig had a conversation in Buffalo:

During the conversation he asked me if I would undertake work in Canada, to make observations and secure such information as I could regarding the Welland Canal, and more particularly calling my attention to the fact of observing how well the canal was patrolled by troops, and to ascertain how many locks there were on the canal and where they were situated. I agreed to perform this work and Koenig gave me the sum of $20 in cash to defray my expenses. . .

Koenig told me that the work I was to do along the canal in the way of making observations was very important and that it would be of great value to him. He also stated to me as near as I can remember that if the locks could be blown up it would cripple commerce and be a benefit to the Germans.

What They Paid Out

Fuchs made a written report to Koenig stating, "that with the use of explosives the canal could be crippled at a spot where the Chippewa River runs under the canal at Welland."

Koenig communicated with the German Embassy concerning the execution of this criminal plot, and frequently received money from both Boy-Ed and von Papen for various kinds of subterranean work. That he was in von Papen's employ is proved by the following entries in the latter's checkbook:

March 29, 1915. Paul Koenig (secret service, first bill), $509.11.
April 18, 1915. Paul Koenig (secret service bill), $90.94.
May 11, 1915. Paul Koenig (secret service), $66.71.
July 16, 1915. Paul Koenig (compensation for F. J. Busse), $150.00.
Aug. 4, 1915. Paul Koenig (5 bills secret service), $118.92.
Aug. 26, 1915. Paul Koenig (various cases in secret service), $247.24.
Oct. 11, 1915. Paul Koenig (4 bills secret service Sept.), $186.47.
Nov. 29, 1915. Paul Koenig (2 cases Reizl. Schumann), $77.24.

Koenig endeavored to protect himself and his fellow conspirators by depositing in the German Embassy at Washington toward the close of October, 1915, such papers as contained evidence of the many criminal plots in which they were engaged.

He did not succeed, however, in concealing all of the incriminating evidence of his plot to destroy the Welland Canal, and with an accomplice, Emil Leyendecker, was indicted on December 23, 1915, for "setting on foot a military enterprise" against Great Britain. The case has not been tried, Koeing being interned as an alien enemy.

Another military enterprise against Canada was undertaken by a prosperous citizen of the German Empire living in Detroit, Albert Kaltschmidt. He was a leader among the German-Americans of his city, had organized the "Deutscherbund" there and was its secretary.

The purposes of Kaltschmidt and his confederates are thus specified in their indictment by the Grand Jury:

(a) "To blow up the factory of the Peabody's Company, Limited, at Walkerville, Ontario, . . . engaged in manufacturing uniforms, clothing, and military supplies. . . .
(b) "To blow up . . . the building known as the Windsor Armories of the City of Windsor. . . . .
(c) "Two blow up and destroy other plants and buildings in said Dominion of Canada, which were used for the manufacture . . . of munitions of war, clothing, uniforms. . . . .
(d) "To blow up and destroy the great railroad bridges of the Canadian Pacific Railroad Co. at Nipigon. . . .
(e) "To employ and send into said Dominion of Canada spies to obtain military information. . . ."

The first grant of money which Kaltschmidt received to carry out these plans was $2,000, deposited on January 27, 1915, in a New York bank by Wolf von Igel. The original order of von Igel that this sum be telegraphed to Kaltschmidt and the latter's receipt for it were introduced as evidence during the trial.

With this working capital Kaltschmidt obtained the materials for his enterprise. In order that suspicion might not be aroused by the purchase of explosives in Detroit, he sent agents to Duluth, where they purchased the necessary dynamite, took it to Detroit, and began the construction of bombs. Two German reservists, Richard Herman and William M. Jarasch, were hired as confederates in Chicago, where the German consul-general, Baron Kurt von Reiswitz, was priv yto the plot. They laid plans under Kaltschmidt's direction to blow up the Detroit Screw Works, where shrapnel was being made, and the St. Clair tunnel which connects Canada with the United States, but failed in both attempts.

Jarosch was tending bar at the time he was hired by Kaltschmidt, and in his statement to an agent of the United States Department of Justice thus tells about other plans in view:

Jacobsen (an aid) told me that munition factories in Canada were to be blown up. Before I left for Detroit Jacobsen and I went to the Consulate. . . . We saw the Consul and he shook hands with me and wished me success. . . . .

Germany's diplomatic representatives were meanwhile supplying Kaltschmidt with money. Captain von Papen on March 27, 1915, drew a check on the Riggs National Bank of Washington for $1,000, payable to Wolf von Igel. Knauth, Nachod & Kuhne on the same day notified Kaltschmidt that von Igel had deposited $1,000 to his credit, and on March 30 Kaltschmidt drew a draft on this bank for that amount.

Charles F. Respa was concerned with operations in Canada, and at Kingston, Ontario, thus told American and Canadian officials what he was hired to do:

Q—How long had you been employed before he (Kaltschmidt) told you that he wanted you to blow up some of these factories?* A—About three weeks. . . .

Q—Did Kaltschmidt at the time speak of any particular place that he wanted you to blow up? A—The particular place was the Armory.

Q—Did he mention the Peabody Building at that time? A—Not particularly—he was more after the bridges and the armories and wanted those places blown up that made ammunition and military clothing. . . .

Q—The explosion at the armories was to be timed so that it would occur when the soldiers were asleep there? A—Yes, he did mention that he wanted to kill soldiers.

Q—Did he say that if the dynamite in the suitcase exploded it would kill the soldiers? A—I do not remember that he said so, but he must have known it.

Q—Did you take both grips? A—Yes.

Q—Where did you set the first grip? A—By the Peabody plant (blown up on June 20, 1915).

Q—Where did you put the other suitcase? A—Then I walked down the Walkerville road to the armories at Windsor and carried the suitcase. . . . .

Q—When you got to the armories did you know where to place It? A—I had my instructions.

Q—From Kaltschmidt? A—Yes. . . .

Q—Did you place this suitcase containing the dynamite bomb at the armory in a proper place to explode and do any damage? . . . . A—Yes.

Q—Was it properly connected so that the can would explode and atrike the dynamite? A—I fixed it so it would not.

Q—Did you deliberately fix this bomb that you took to the armories so that it would not explode? A—Yes.

Q—Why did you do that? A—I knew that the suitcase contained 30 sticks of dynamite and if exploded would blow up the armories and all the ammunition and would kill every man in it.

Respa, carelessly entering Canadian territory, was arrested and put on trial at Sandwich, Ontario. Kaltschmidt sent a friend to New York City to hire two witnesses to establish an alibi. This friend was instructed to call at the office of Captain von Papen, and upon giving the name Verner was to receive $1,000. Von Papen paid him the money, the two

*Respa and his accomplice were promised $200 each for their crime.

witnesses were brought to Detroit, but being entirely unsuitable for the desired purpose were sent home. The balance of the $1,000 was turned over to Kaltschmidt.

The last known financial transaction between Kaltschmidt and a member of the German Embassy is represented by the following letter:

H. F. Albert, 45 Broadway,
New York, Oct. 4, 1915.
Chase National Bank, 57 Broadway,
New York City:
Geneltmen:—Please deposit with Knauth, Nachod & Kuhne, New York, $25,000 (twenty-five thousand dollars) for account of Mr. Kaltschmidt, Detroit, and charge a like amount to my joint account with J. Bernstorff.
Yours very truly,
HEINRICH F. ALBERT.

Kaltschmidt was arrested in April, 1917, and his trial completed during December of the same year. The jury found him guilty on all charges in the indictment, and he was sentenced to four years in the Federal prison at Leavenworth, Kansas, and to pay a fine of $20,000. His sister, Ida K. Neef, was sentenced to three years in the Detroit House of Correction and to pay a fine of $15,000. Her husband, Fritz A. Neef, was sentenced to two years at Leavenworth and to pay a fine of $10,000. Two other accomplices received lighter sentences.

Another and more successful attack on the Grand Trunk Railway was made at Vanceboro, Maine, where it crosses the international bridge between the United States and Canada. Captain von Papen ordered Werner Horn, a German reserve lieutenant, to blow up the bridge and supplied him with $700. Horn was arrested immediately after an explosion which partly damaged the bridge, and at his trial in Boston, during June, 1917, made the following confession on the advice of his lawyers:

I admit and state that the facts set forth (in the indictments) as to the conveyance of explosives on certain passenger trains from New York to Boston and from Boston to Vanceboro, in the State of Maine, are true. I did, as therein alleged, receive an explosive . . . and conveyed the same from the City of New York to Boston . . . thence by common carrier from Boston . . . to Vanceboro, Maine. On or about the night of February 1, 1915, I took said explosive in a suitcase in which I was conveying it and carried the same across the bridge at Vanceboro to the Canadian side and there about 1.10 in the morning of Feb. 2, 1915, I caused said explosive to be exploded near or against the abutments of the bridge on the Canadian side, with intent to destroy the abutment and cripple the bridge so that the same could not be used for the passage of trains.

Horn was found guilty and sentenced to eighteen months at Atlanta penitentiary and the payment of a fine of $1,000.

The official representatives of Germany on the Pacific coast endeavored not only to sink ships, but also to carry out the command of the German General Staff that the Canadian Pacific Railroad be crippled. Franz Bopp, the German Consul-General in San Francisco, and his associates conspired to blow up the tunnels through which the railway passes under the Selkirk Mountains in British Columbia. They hired for this task J. H. van Koolbergen, the man who designed for them the bomb to be used on ships.

In the statement to the British authorities already quoted, van Koolbergen tells the story of this undertaking. After testifying that Lieutenant von Brincken summoned him by telephone, he continues:

Not knowing what he wanted I went to see him. . . . He was very pleasant and told me that he was an officer in the German army and at present working in the Secret Service of the German Empire under Mr. Franz Bopp, the Imperial German Consul. . . . .

I went to the Consulate and met Franz Bopp . . . and then saw von Brincken in another room. He asked me if I would do something for him in Canada . . . and I answered him, "Sure, I will do something, even blow up bridges, if there is money in it." . . . And he said, "You are the man; if that is so, you can make good money."

Von Brincken told me that they were willing to send me up to Canada to blow up one of the bridges on the Canadian Pacific Railroad or one of the tunnels. I asked him what was in it and he said he would talk it over with the German Consul Bopp. . . . .

I had accepted von Brincken's proposition to go to Canada and he offered me $500 to defray my expenses. . . . On different occasions in his room von Brincken showed me maps and information about Canada and pointed out to me where he wanted the act to be done. This was to be between Revelstoke and Vancouver on the Canadian Pacific Railroad, and I was to get $3,000 in case of a successful blowing up of a military train or bridge or tunnel.

After making a pretended attempt in collusion with Canadian railroad officials to blow up the tunnel, van Koolbergen returned to San Francisco and called on Mr. Bopp, who—

ordered the Vice Consul, Mr. von Schack, to pay me the additional $300 for traveling expenses. Mr. Bopp . . . ordered Mr. von Schack to get the money from the safe, and it was paid to me in greenbacks in the presence of Mr. von Schack, Mr. Bopp, and Mr. von Brincken. I agreed that I would be satisfied with $1,750 for my services in blowing up the tunnel, instead of the $3,000 as was first agreed upon and I was promised the money the next day. . . . .

I met von Brincken that (the next) afternoon and he brought $1,750 in greenbacks. Mr. Brincken had made arrangements before that with me that he should get a certain portion of the money from me; and I was paid $1,500, and $250 he got himself.

The information contained in the statements of Mr. van Koolbergen and L. J. Smith combined with a large amount of other evidence caused the Grand Jury to indict Bopp, von Schack, von Brincken, Crowley, and his secretary, Mrs. Margaret W. Cornell, for conspiracy to prepare and set on foot a military enterprise against Canada. All were found guilty and the men sentenced to serve two years in the penitentiary and to pay a fine of $10,000 each, with concurrent terms of one year in the county jail. Crowley and Mrs. Cornell, who received a lighter penalty, are now in prison; the others appealed to a higher court.

The men engaged by Consul-General Bopp at San Francisco attempted also to interrupt transportation of military supplies from the United States to Canada by crippling the Grand Trunk Railway. In his charge to the jury already quoted, the presiding justice said:

Smith says he went to Detroit and met Crowley; that they went to Port Huron to see about a tunnel running from Port Huron to Sarnia; Crowley told him that trains would come through about every six hours and that he should go down to where they fed the horses, and as they were being fed he could place a bomb in the cars and set the fuse long enough to explode the bomb in the car near the centre of the tunnel.

Nothing was accomplished here and the men returned to San Francisco.

QUIETENING WORN GEARS

By T. H.

The question of the suitability of ground cork as a quietening agent for noisy epicylic gearing recalls to mind several peculiar recipes that were in vogue a few years ago to suppress the noisy humming of more or less worn-out gears. The mixing of a liberal quantity of sawdust with the lubricant was one, whilst another was the charging of the box as full as possible with shavings of the sort used for packing fragile goods in, the usual lubricant being allowed to remain in.

The principle upon which these media were supposed to be based was that of acting as a cushion in between the teeth of the pinion and reducing the shock which set up the objectionable humming and vibration. Cork, being a much more elastic material than sawdust, ought to be more efficient for the purpose. Ground rubber might be even better but for the serious drawback that it would soon form a semi-fluid mass by reason of the action of the oil upon it, a fault which would not be found with cork, although any medium would ultimately lose its properties by being ground to a fine state of division.

There is some evidence that the plan of introducing sawdust, etc., into the gearbox is at least temporarily effective. It is not unknown to some of those who prepare second-hand cars for sale; and that even public service vehicles have managed to pass a silence test by this means.

It may be asked what, if any, objections are there to the plan. There does not seem to be any obvious reason why it should cause mechanical injury to the gearing providing that no solid matter is introduced, such as pieces of metal, which would jamb the gear, but there is at least one serious objection of another sort, viz., great waste of power by friction, due to the churning up of the semi-plastic mass by the gear teeth; the gear-box would, in fact, be acting as a continuous brake. There is also the difficulty of the proper lubrication of the gearshafts and bearings. The former would very likely make itself felt by causing stiffness in the operation of changing the gears.

Additional Power At Small Cost By Exhaust Steam Turbine

Exhaust Steam Turbines Connected to Line Shaft Through Reduction Gears With Beneficial Results in the Saving of Fuel and Boiler Capacity

MOTOR drive, the simplest solution to additional power problems, is often not available to mill owners, whose plants are driven by line shafts. Often, however, there is sufficient boiler capacity in his plant to do the work, if it is effectively applied, particularly where line shaft drive to a small number of machines is used. The installation of a turbine with speed-reducing gears is an ingenious solution to the problems.

A unique line shaft drive, consisting of a Westinghouse low pressure turbine and a Westinghouse double reduction gear has been recently installed in a large paper mill. There are two main line shafts to which the machines are belted. To one of the line shaft are belted two cutters, ten beaters and one Jordan; an identical equipment with the exception of the cutters is belted to the other shaft.

Only seven of the ten beaters, under ordinary running conditions are in operation at one time, and these with one Jordan require about 600 horse power, an additional 20 horse power for the rag cutters.

Heretofore, these two line-shafts were each driven by a non-condensing reciprocating engine. However, one of these engines was wrecked and so necessitated the obtaining of a drive to replace it, at the least ultimate expense.

It is interesting to note the considerations entering into the final selection of the new drive. These conditions were somewhat as follows: two 100 horse power non-condensing engines turned the rolls and gave practically all the exhaust steam necessary for feed water heating, so that all the exhaust steam from the 700-horse-power non-condensing Corliss engine driving one of the line shafts would have to be discharged to the atmosphere, unless some means were provided for abstracting the energy still available in it. A low pressure turbine was the prime mover, without a doubt, but it would have been of little use, on account of its high speed, had there not been a reduction gear to receive the power generated to deliver it to the line shaft at low speed.

Other types of drive were considered, but each had inherent characteristics which disqualified it. For instance, a duplication of the old reciprocating engine was stepping back into the old rut, with the inevitable wasting of exhaust steam. A condensing engine would have been expensive, and no material improvement. Again, an electric motor, while comparatively cheap to instal, would have been much more expensive, when the electric power bill was added to the cost of energy lost in wasted exhaust steam. And finally, it was still more expensive to instal a turbine generator and an individual electric drive, because the existing equipment was of an entirely different character. However, in a new plant, where all equipment is being installed for the first time, the individual electric drive is by far the best, for reasons too well known to need discussion here.

A few approximate figures show more clearly the fitness of low-pressure turbine for this application. The exhaust steam from the 700-horse-power Corliss engine was more than sufficient to give 600 horse power in the low pressure turbine. The engine takes steam at 150 pounds pressure, and exhausts into an oil separator at a back pressure, depending on the load, from 0 to 4 or 6 pounds, which is approximately the pressure of admission to the low pressure turbine. The steam is then expanded in the turbine down to a vacuum corresponding to 27½ inches of mercury referred to a 30-inch barometer, the vacuum being maintained by a Westinghouse-Le Blanc low level jet condenser and air pump. The pumps are centrifugal and are driven by a small turbine through a reduction gear. They take their water from a nearby creek and discharge it from the condenser into a reservoir at an elevation of 45 feet, which water is used in the manufacturing processes. The small turbine runs non-condensing, and its exhaust steam goes to the feed water heater, so that only a part of the heat energy in the steam used by it can be charged to the turbine, and even that cannot be charged against the main turbine for it is used to do work in elevating the discharge water from the condenser to the reservoir and should be charged against the total cost of manufacturing. In brief, it may be said that this paper company actually gets 600 horse power without paying a cent for steam, and that it is using just one-half the steam they formerly used with two reciprocating engines to obtain the same power.

While this particular mill was not en-

VIEW OF TURBINE AND DOUBLE REDUCTION GEARING.

larged, it is evident that with a given amount of exhaust steam, either from non-condensing engines or condensing engines run non-condensing, a large increase of power is made available by the installation of a low pressure turbine. Further evidence of this possibility for expansion is the fact that in this paper mill when the two line shafts were driven by non-condensing reciprocating engines, a battery of 13 boilers was required, whereas now only eight boilers are required for the maximum load.

So far this has been a discussion of the application of a low pressure turbine, but the means of transmitting its high speed power to a slow speed line shaft is fully interesting and as important. The change in speed is made by means of two reduction gears because the first cost of a single gear and pinion of ratio 36 to 1 would be prohibitive, and the gear would be very large and unwieldy. The first speed reduction, 3,600 r.p.m., to 720 r.p.m., is made with a fixed bearing type of reduction gear, the gear shaft of which is direct connected to the pinion shaft of the second gear which reduces the speed from 720 to 103 r.p.m.

This larger reduction gear is of the flexible pinion frame type, better known as the Westinghouse I-beam type. It is this I-beam feature which makes the application of the geared drive possible.

In this the pinion is supported on three bearings in a frame, as shown in Fig. 3. This frame is supported under the middle bearing on an I-beam at right angles to the pinion axle. The flexibility of the web of this I-beam support allows the pinion to tip slightly and to let the teeth of the pinion line up with those of the gear. This lining-up is entirely automatic and instantaneous in operation, so that no mechanical complications are encountered, and no adjustments from the outside of the gear case are necessary at any time.

Both reduction gears are lubricated by sprays of oil directed upon the teeth just before the mesh. The pressure is maintained by a pump geared to the gear shaft, as shown in Fig. 11. This pump also supplies oil under pressure to all the bearings in the two reduction gears. For starting, a hand pump is provided which insures a plentiful supply of oil on the bearings and teeth.

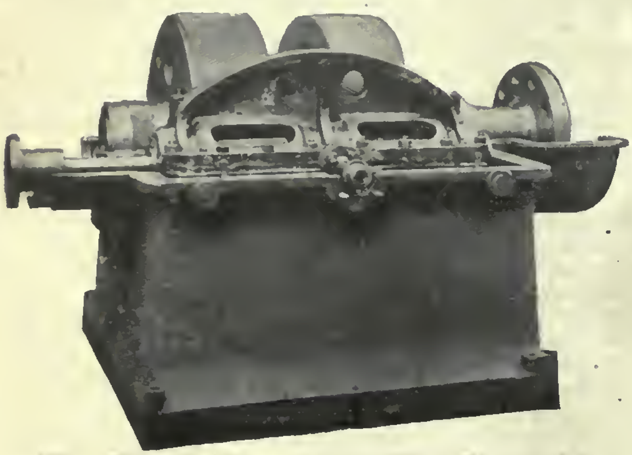
It may be asked why a fixed bearing type of reduction gear was used in one case and an I-beam in the other. It was a question of tooth pressure which determined the design. Take for instance a pinion transmitting 600 horse power at 3,600 r.p.m., which was the case of the first reduction gear in the particular installation under discussion. If the same pinion were to turn at 720 r.p.m. and with the same tooth pressure (i.e., pounds pressure per inch) of tooth face it would be capable of transmitting one-fifth of 600 horse power, or 120 horse power only. It follows, then, that the second gear would have been made five times as large as the first if the same type had been used, and for the transmission of the same amount of power. Such reduction gear would have been large and bulky. It would also have been costly, because cost is a function of size.

In order, then, to make a reduction gear which would be within reasonable limits as to size, and at the same time marketable, the allowable tooth pressure had to be increased, or in other words the factor of safety included in the allowable stress in ordering fixed bearing design had to be lowered. But if this were done, some other safety factor would have to be incorporated to insure reliability of operation, otherwise a slight misalignment of the teeth and uneven distribution of tooth pressure would have resulted in a failure of the gear.

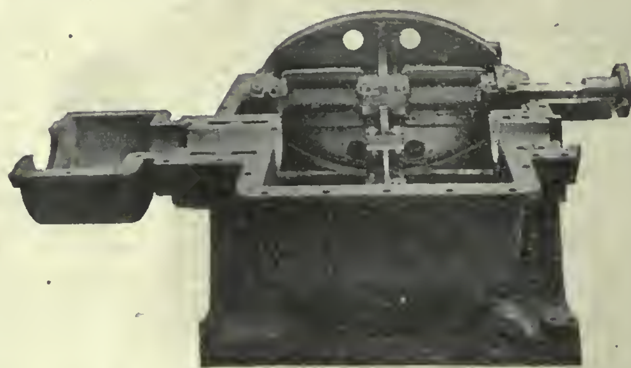
This safety factor was found in the Westinghouse I-beam support for the pinion which corrects any misalignment and uneven pressure distribution which might otherwise exist. Misalignment might have been due to temperature changes, slight but unavoidable inaccuracies in workmanship, or distortion of the bearing supports in the housing, due to varying loads or changes in foundations, and if not corrected would have caused the total tooth pressure to be concentrated at one part of the tooth which would have overstressed that part of the tooth and have caused it to fail.

In the case of the reduction gear with fixed bearing support for the pinion, misalignment, although practically prevented by good workmanship, will not have disastrous results if it should exist, because of the high factor of safety used in the tooth design. In other words, localization of total tooth pressure would not stress the metal beyond a safe limit.

The self-aligning feature, the forced lubrication, the rugged construction of the parts, and the workmanship on these reduction gears make them a very efficient and reliable means of transmitting power. The actual efficiency of the two gears together is 97 per cent., showing that only 3 per cent. of the total power transmitted is lost in them. This energy is dissipated in the form of heat, and is taken up by the oil, which in turn is cooled by a water cooling system. As to reliability, in the paper mill under discussion the double reduction gear has run 24 hours per day, six days per week, under maximum load, and it has never been shut down on account of trouble with the gears.



REDUCTION GEARING SHOWING FLOATING FRAME.



THE THREE PIONION BEARINGS ARE SUPPORTED ON A FRAME WHICH IN TURN IS SUPPORTED ON TWO SUPPORTS OF "I" BEAM SECTION.

CEMENTS FOR PIPE JOINTS

By M. E.

Cement for making screw joints in pipes steam-tight may be made from graphite and heavy cylinder oil. Just enough oil is mixed with the graphite to form a thick paste.

A good cement for both water and steam pipes has this composition: Whiting, 4 pounds; fine yellow ochre, 10 pounds; ground litharge, 4 pounds, and one-half pound of hemp cut into fine particles. These ingredients are mixed thoroughly with linseed oil to form a paste, which is applied on the threads of the pipes, etc.

For ammonia piping, a cement made of litharge and glycerine is used. Sufficient glycerine is added to the litharge to form a putty. Only enough of this cement should be mixed to serve immediate needs, as it sets quickly. After having once set, it should not be disturbed.

574. Galvanized sheets.—A Liverpool firm would like quotations on 100 tons of galvanized sheets, assorted, 6-foot to 10-foot lengths by 8/3 by 24 G., in bundles, felted for direct shipment to Callao, South America.

Tracing the Development and Use of Semisteel

Great Use Was Made of it in France to Secure Great Amount of Munitions in 1917—Greatly Used in Auto and Truck Trade—McLain Has Much to do With it

THE progress shown and recorded in the advancement and uses of semi-steel since 1903, when the last Foundrymen's Convention was held in Milwaukee, is remarkable. It is undoubtedly true that the history of the successes of other industries is made with many obstacles and semi-steel was no exception.

For fifty years or more, foundrymen had added steel to iron in the ladle—while comparatively few melted slight amounts of steel in the cupola. According to an English authority a patent was issued on the manufacture of a new cast or wrought metal containing steel more than half a century ago, and this discovery then was acclaimed by British foundrymen generally as semi-steel. To the late Major McDowell of Chicago must be attributed the honor of placing the semi-steel process on a scientific basis and upon his great work as a foundation the accomplishments of to-day have been made possible.

But up to 1902 or 1903 no record was found where large percentages of steel was used in castings of *light* section. It remained for David McLain of Milwaukee to perfect experiments along this line and give to the world a metal that would be put at the top of the list of cupola or air furnace metals, and he called it semi-steel.

Until the past five years semi-steel has been ridiculed and classed as a misnomer by even some of the foremost metallurgists in the field, but to-day our Government is specifying semi-steel projectiles and shells by the million.

Just about a year ago it was claimed that semi-steel shells saved France. One of the most striking cases of efficient substitution is illustrated in the French semi-steel shells replacing steel. To further show the characteristic of the French genius in meeting spontaneously an emergency, that with a sudden shortage of steel and with the greater part of their blast furnaces in enemy hands, little iron foundries were established everywhere—almost literally over night—and the necessary output of shells thus maintained.

The best proof of its value and its existence as a distinct product is the fact that the bulk of the automobile and motor truck cylinders used in this country to-day are made from semi-steel, and it is the only metal that has been able to drive from the American market the wonderful cylinder castings shipped into this country in the past from France at fabulous prices. But the use of semi-steel not only is limited to comparatively light work. Many foundries have established a reputation for the manufacture, under high-sounding trade names, of vacuum cylinders and ammonia steel castings which, upon investigation, are found to be semi-steel. The foregoing are only a few instances of the remarkable accomplishments of semi-steel. They could be multiplied indefinitely.

The Beginning of a New Era in Metallurgy

In 1899, the Christensen Engineering Company (now the National Brake and Electric Company, Milwaukee) built their first foundry. Gray iron, steel and brass castings were made in this plant and David McLain was the foundry superintendent for five and one-half years.

Certain parts of the air brakes were only 5/16 inch thick and tested to 200 pounds air pressure, although other engineers allowed one inch. Founders everywhere who made these castings experienced excessive losses, making it difficult for this firm to fill their orders. This was the condition when Mr. McLain was engaged. Much of the history of his experiments have been told in these columns before, so we will not dwell on this part except to emphasize the fact that he was successful in demonstrating that these castings could be made by adding 25 to 40 per cent. steel.

Mr. McLain's friends insisted that he patent his formulas, but he believed in spreading his knowledge of this metal to the foundry trade gratuitously. At that time he was anxious to enlighten foundrymen everywhere on the merits of this wonderful metal, and later, through the kindness of Mr. R. P. Tell, general manager of the National Brake & Electric Company, copies of Mr. McLain's first paper on semi-steel were typewritten and sent to foundrymen everywhere.

It was proven by later demonstration that semi-steel is a purer and stronger metal than gray iron—stands the test for Government specifications for projectiles (32,000 pounds tensile)—and when used with 30 to 50 per cent. steel scrap will run as high as 40,000 and 45,000 pounds.

Prominent technical and practical foundrymen, some of whom no doubt will attend this meeting, maintained that steel reduced carbon, that it was not a good thing to use as it caused "hard spots"—that "a higher melting temperature was necessary"—"more coke required to melt it," etc. Even to-day, Mr. McLain's claim that steel melts first puzzles some chemists, metallurgists and others, who evidently do not take into consideration that steel has a great affinity for the elements and absorbs a large quantity of carbon from the fuel.

When properly made semi-steel exceeds in both temperature and fluidity any other mixtures melted in the cupola. Semi-steel is made in the same cupola with regular gray iron mixtures—no extra coke—special appliances—fluxes—or new equipment are necessary.

It is made in the same heat with other mixtures—it may be melted in the early part of a heat—in the middle or last part of the regular heat. Or you may begin with 30 to 40 per cent. steel on the bed charge—run as much of this grade as required and then follow with 20 to 25 per cent. steel—or vice versa.

Mr. McLain claims that every industry has its science and up-to-date foundry practice is no longer guess work—it is a science. But science does not replace common sense; and in an industry like the metallurgy of iron and steel there can be no set rules that will cover the operations or the operators in the manufacture of every grade of castings. We need men with common sense to apply scientific facts to their individual requirements and local conditions.

He also claims that any man who believes that he can simply throw some steel scrap in with the pig iron and make good semi-steel has much to learn. But such is the custom in a large number of shops in which Mr. McLain is called in an advisory capacity.

Our Government has specified twelve million semi-steel shells to be made, and this would require an approximate of 400,000 tons of pig iron, so it behooves every up-to-date foundryman to be able to meet Government specifications and help win the war.

Another feature of semi-steel is the extraordinary uniformity of a series of samples. Although the castings are of exceedingly varying weights, some having thick sections and others very thin sections, the metal microscopically is exceedingly uniform, much more so than you find in gray iron, for the majority of foundrymen realize that where the section of a casting is light there is a tendency for the iron to be hard and brittle unless the chemical composition is modified to suit the weight of the casting.

Mr. McLain does not claim to be the first man who used steel in cupola mixtures, as for over fifty years steel was carelessly used in large castings where it did not matter how it was melted: but he has the honor of being the first man who was successful day after day in using *large percentages* of steel in castings of *light* section.

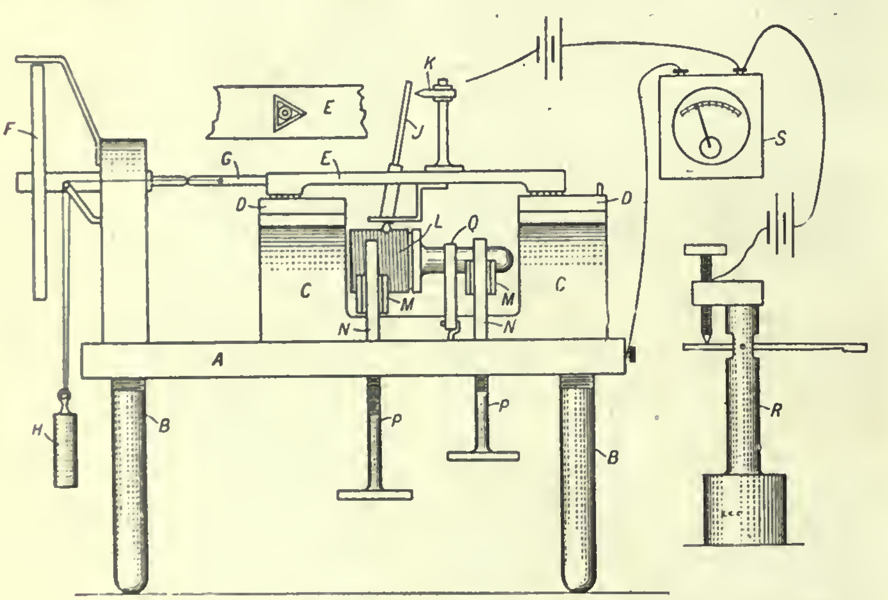
Volumes might be written about semi-steel, but the very fact that the Convention is to be held in Milwaukee will enable hundreds of foundrymen to view an exhibit of semi-steel castings made by graduates of McLain's system.

Hamilton.—The amount of work being carried on by the Dominion Foundries and Steel have made another extension necessary to their plant. This will take in three storeys and will cost about $75,-000.

PITCH MEASURING MACHINE FOR SCREW GAUGES

IT is now generally agreed that the inspection of screw gauges for the correctness of the pitches of their threads should be carried out from thread to thread, and should not be made over a given number of threads or over the threads lying within a given length, say, half an inch. The possible errors in the pitch of a thread are of two kinds, namely, variable and progressive. The error is variable if the pitch varies from thread to thread in an erratic manner. Such error may arise in a screw gauge from distortion after hardening or from faulty adjustment of the thrust bearing of the leading screw or grinding machine on which the gauge has been made. With a progressive error the pitch increases or decreases from thread to thread at a uniform rate. This defect may be due to a bad leading screw or to the lap used for finishing the gauge not having identically the same pitch as the thread on the leading screw, a possibility that may arise if the gauge and the lap are not made on the same machine.

In practice both types of error frequently occur in combination, the result being, of course, a variable error. It thus clear that the mean of the total error, measured over a number of threads, can only be a true measure of the error in any one pitch if that error is purely of the progressive type. If the pitch error is variable, or variable and progressive, the individual errors over, say half an inch, being sometimes positive and sometimes negative, may, in an extreme case, add up to zero, and in any event add up



—DIAGRAM OF THE BENGHAM-POWELL PITCH MEASURING MACHINES.

to some figure which, when divided by the number of pitches in the length chosen, cannot in general be regarded as a satisfactory measure of the error of any one pitch in the length.

Reflecting Indicator

These facts have led to the general abandonment of methods of inspecting the correctness of pitch on screw gauges based on the use of vee-pointed blocks separated by plain blocks—such as Johannsen gauge blocks—of known thicknesses. Thus the instrument now in use for this purpose at the National Physical Laboratory examines each pitch separately in succession. It consists, briefly put, of a lever carrying a ball at one end, which ball, by the action of a spring bearing against the lever, is held pressed into the threads of the gauge to be tested. As the gauge is moved past the lever the ball rides in and out over the crest of the threads down into their troughs and out again. By watching the movement of a spot of light reflected from a mirror attached to the lever, the instant at which the ball crosses the crest of a thread can be very clearly determined by means of a micrometer attachment on its carriage, and is, of course, a direct measure of the pitch between the two crests. The reversal in the motion of the spot of light which occurs when the ball reaches a crest is stated to be sharp and clearly defined, and to afford an accurate means of measuring the pitch. The method is applicable both to plug and to ring screw gauges. An instrument of this design is now in use at the laboratory of the United States Bureau of Standards.

The pitch measuring machine illustrated diagrammatically in Fig. 1 is the patented invention of Mr. H. T. Bingham Powell, the inspector in charge of the department of gauges and standards of the British Ministry of Munitions of War in the United States. It agrees with the Teddington machine in measuring by micrometeric means the individual successive pitches of the thread, and in employing a ball as a basis for so doing. But in all else it is essentially different.

The machine comprises a base A in the form of a surface plate supported at the corners on legs B screwed for levelling purposes. At the rear of the base plate a pair of overhanging cast iron brackets C are fixed, each bracket carrying a facing D of hard steel, in which double vee-ways are formed to accommodate a number of bearing balls. A carriage E, the ends of which are also formed with double vee-ways, bridges the brackets

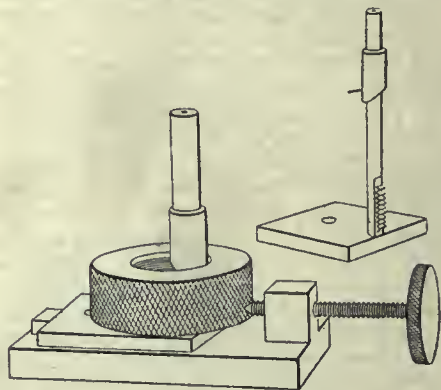


FIG. 2—TAKING A THREAD CAST.

and slides on the balls. The movement of the carriage is effected and measured by means of a micrometer head F, the spindle of which is rounded at the end and bears against the rounded end of a spindle G fixed to the carriage. The two spindles are held constantly in contact by means of a weight H united to the spindle G by a double cord passing over hooks. The micrometer head permits the easy reading of a movement of the carriage amounting to one ten-thousandth of an inch. On the axis of the carriage is a vee-shaped opening, within which there is placed a spindle J formed with a small ball at its end. The lower end of the spindle is of larger diameter than the portion above the vee-opening, and is guided between the forks of an L-shaped piece attached to the underside of the carriage. The opening between the forks is only about 1½ ten-thousandths of an inch greater than the larger diameter of the spindle. The spindle is thus practically entirely free to rise or fall or swing in the vertical plane, but is constrained from moving sideways. The end of the spindle works in conjunction with a knife-edged electrical contact K mounted between insulators on a post fixed to the top of the carriage.

The screw gauge L rests on vee-blocks, the edges of which are formed with ways so that the blocks may slide on posts N fixed into the base plate. Each block is raised or lowered by means of a fine screw P situated midway between its two posts. The gauge is held in place on the blocks by means of a stout rubber band Q passed over its handle and over hooks fixed in the base plate.

Operating Considerations

Before the apparatus is used it is most important to make sure that the tops of the threads on the gauge lie truly in a horizontal plane. For this purpose there is provided an "electric level" R, consisting of a post, the base of which is rested upon the surface plate A of the machine. The post caries a pivoted lever, one end of which is acted upon by an insulated adjusting screw. This screw is connected to a battery and a galvanometer S. is therefore in electrical connection with is connected to the surface plate A, and The second terminal of the galvanometer rises into contact with the end of the pivoted arm, and just breaks the galvanometer circuit at the point of the adjusting screw. The level is threafter transferred to the other end of the threaded part of the gauge and there used in a similar manner.

The ball point on the spindle J is then placed in the first thread on the gauge, and the carriage E moved by the micrometer wheel until the end of the spindle just makes contact with the knife edge K, a condition noted by the occurrence of a deflection at the galvanometer. The reading of the micrometer is noted and the point of the spindle transferred into the second thread. The carriage is again moved until electrical contact is once more just established. The difference between the micrometer reading in this condition and that first determined is directly equal to the length of the first pitch. The succeeding pitches are then similarly examined. The ball point and the gauge must be free from dirt and oil in order to get electric contact. This fact is a factor favoring accuracy.

To permit the pitch of a ring screw gauge to be examined in a similar way a cast is made of the threads. The material used for the cast is a composition of 7 per cent. graphite and 93 per cent. sulphur. A cast of the complete interior of the ring is not taken, for such a cast is apt to be broken during its removal, or, if the material used is at all plastic, to have all its threads, in form and pitch, a more or less exact copy of the last thread on the gauge. The simple apparatus illustrated in Fig. 2 has been devised to permit a small segment of the thread to be copied in a cast. The device consists of a small square base plate of steel ground true on the surface and provided with a spindle screwed into it exactly at right angles to its plane. The spindle is formed with a wedge-sectioned slot towards its foot. In use the ring gauge is clamped against the spindle in the manner indicated towards the left, and a sleeve surrounding the spindle is lowered to close up such portion of the slot as is not covered by the threads. The melted composition is then run into the slot and allowed to set. The cast thus left in the slot in the spindle, being at right angles to the base plate, is correctly parallel with the centre line of the gauge. Without removing it from the spindle it is taken to the pitch measuring machine and there examined. The narrow side of the slot is faced downwards in the measuring machine so that the cast will not fall out of it. The spindle is provided with centres at its ends, and can therefore be readily supported in the optical projection apparatus devised at the National Physical Laboratory for examining the angle and form of the threads.

THE ECONOMICS OF SHIP REPAIRS

By M. M.

The managers of some of the ship repairing establishments around the Coast will have some interesting jobs to describe when conditions permit, as the extent and variety of the work they have tackled during the past two years have been far in excess of any, except "freak" jobs, which were taken in hand in pre-war days. The relatively low cost of new tonnage then rendered it uneconomical to undertake any repairs which were more than reasonably lengthy and difficult, with the result that vessels were broken up which nowadays would fetch a very substantial figure even before repair. Under the system which has been set up during the past years the fullest possible advantage can be taken of the resources of the many repairing firms, from those of large size down to the smallest and least well-equipped. As a consequence the speeding up of repair work has been very marked, and it is difficult to estimate the value of the work the department responsible for repairs has accomplished.

Centralized Control

Now that there is a centralized control of repair work, it would appear practicable and also very desirable to adopt some means of disseminating such information as might be of value, regarding the manner in which certain important repairs have been effected. There is a "best" way of tackling every job—of course, dependent on the plant and equipment available—and from experience of the many repairs which have been carried out, it should be possible to arrive at the "best" method rapidly in the case of any new job. So far as one is aware, there is no such scheme for spreading useful information in this country, although everyone who has read the detailed accounts of the repairs made by the Americans to the damaged German merchant vessels cannot but be impressed by the probable value of these reports to firms who may be confronted with the work of making good somewhat similar damage. There must be very numerous cases in which damage to a vessel due to mine or torpedoes has resulted in the fracture of important hull and machinery castings, and it would be very instructive to have some idea of the manner in which these damaged items have been repaired. It is probable that the very large majority of such fractures have been made good by furnishing replace parts rather than actually repairing the castings themselves.

Replacing Castings

The policy of ordering replace castings instead of making good the broken ones is open to many objections. In the first place it is usually very wasteful of time, as such new parts have to be put through foundries already crowded with work for new vessels. Further, the length of time required for turning out a new casting is usually considereble, even if the job is given very first attention, while this latter procedure often results in a very uneconomical dislocation of the normal run of the work in the foundry. It is often necessary to patch up an old or to make a new pattern, no easy task where a stern frame or similar large part is required, while work at the vessel in the vicinity of the damaged casting is hung up until such time as the new casting has been delivered. The period for such delivery is rarely short and it may run into four or five months.

Methods of Repair

Where it is even remotely possible to effect a sound "war-time" repair by any of the several methods which can be adopted, there is no doubt but that the attempt should be made. It may not be possible to maintain the full strength of the original casting in the repair, but if a right sense of balance and proportion is brought to the consideration of the job, there is little doubt but that very many repairs which would have been considered as "not quite" satisfactory in peace time will be undoubtedly accepted as amply good enough under present conditions. After all one cannot help feeling that there is very little justification for putting, say, a brand new stern frame into a vessel which is only good for another few years, when the broken frame previously in the vessel would have been repaired sufficiently to ensure its outlasting other parts of the hull, or to put the matter in another way, when repair to the broken frame would have resulted in altering factor of safety in other parts of the ship. A vessel has a certain factor of safety when built, which factor applies more or less uniformly to the whole of the major portions of the ship structure. Deterioration naturally results in a reduction of this factor, and there are undoubtedly many vessels now on service in which the factor of safety in some portions of the vessel is a very little more than one.

Repairing Castings

As there are several methods by which it is possible to repair castings so as to obtain not less than 60 to 80 per cent. of the original strength, it would appear desirable that very careful attention should be paid to the possibility of effecting repair to the damaged item, and a replace part ordered only if it is found essential, having regard to the whole circumstances of the case. Demands on founaries are so large that everything possible should be done to relieve them. It may be thought that delay would be involved, should it finally prove absolutely necessary to order a replace casting, owing to the time spent in considering the question as to whether or not the old casting could be repaired, but this could be avoided if all the work preliminary to ordering the casting was carried out while this matter was under consideration. Further, if the services of experts in say electric welding and thermit were obtained it should be possible to rapidly arrive at sound conclusions.

Using Ball Bearings in Marine Machinery

In Sweden Great Strides Were Made in This Direction—Assist in Securing Easy and Reliable Running, and Thus Getting Greater Radius of Action—Business Growing in Canada

THE use of ball bearings in marine engines and in nautical machinery generally has been developed to an important exten in Europe by the Akti bolaget Svenska Kullagerfabriken of Gothenberg, Sweden. This concern was the original manufacturer of the S K F ball bearings which are also manufactured in the United States. The fact that these bearings are well known both in Canada and the United States will tend to create interest in some recent applications, particulars of which are given below. The installations have already proven successful and have demonstrated the efficacy of ball bearings in marine work. When constructing nautical machinery, driven either by internal combustion motors or else steam engines, unceasing efforts are made to attain the greatest possible saving in power and the most reliable running obtainable. The reason why ball bearings are of such significance in nautical machinery in general is due to the importance that is attached to easy and reliable running, factors that very largely increase the vessel's radius of action.

Connecting Rod Bearings

Ball bearings are largely used for the frames and conecting rods of internal combustion motors. In one case ball bearings were mounted in a motor with four cylinders. The bearings of the connecting rods were so large in diameter that they were slipped over the joints of the shoulders. The bearings were in all instances held fast by means of nuts against the shoulders. These bearings have also been mounted in motors with only one cylinder. In this case the shoulder is split, thus permitting the bearing rod to be mounted easily.

Propeller Shaft Bearings

The so-called "cam bearing" that has up to the present been employed for taking up the propeller pressure, has not satisfied the exacting demands that must be placed on the reliable running of a bearing of such moment for the navigation of the vessel. The loss of power entailed by gliding friction is considerable, and the propensity for becoming overheated great.

DETAIL OF THRUST BEARING FOR DIESEL ENGINE.

It can easily be understood that ball bearings have a great mission to fill, and all the applications carried out by Svenska Kullagerfabriken have given excellent results.

Besides being used on the propeller itself, ball bearings are used for supporting the propeller shaft. These bearings have been found most advantageous, especially for propeller shafts running at high speeds, or shafts of great length where the downward movement necessitates the use of a bearing constructed on self-aligning principles.

The Turbine Steamer "Mjolner"

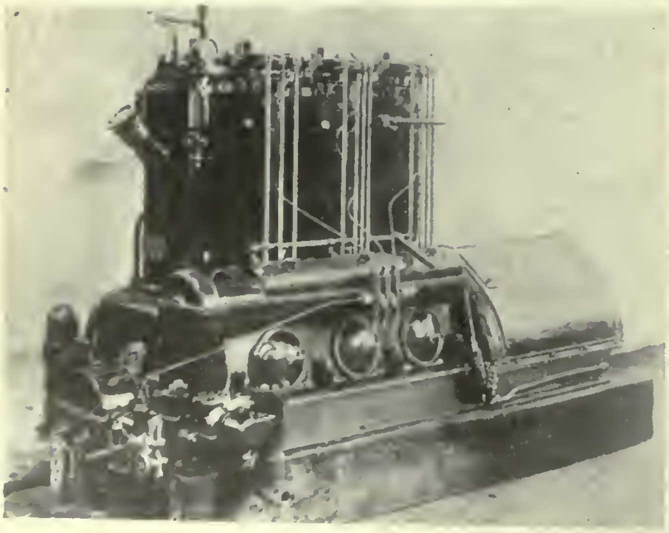
The S. S. "Mjolner," which was built some years ago and equipped with 900 h.p. motors, was fitted with ball bearings. A gliding "cam bearing" of the usual type was applied simultaneously as a reserve for taking up the propeller pressure in case the ball bearing should become unusable in any way. However, the ball bearings exceeded all expectations, for which reason the gliding bearing has now been removed.

Propeller Thrust Bearings

One of the accompanying illustrations shows a propeller equipped with ball bearings. The axial bearings are mounted on split sleeves so designed that the centre of the bearing's spherical seating coincides with the centre of the radial bearing, making the entire bearing self-aligning around this point.

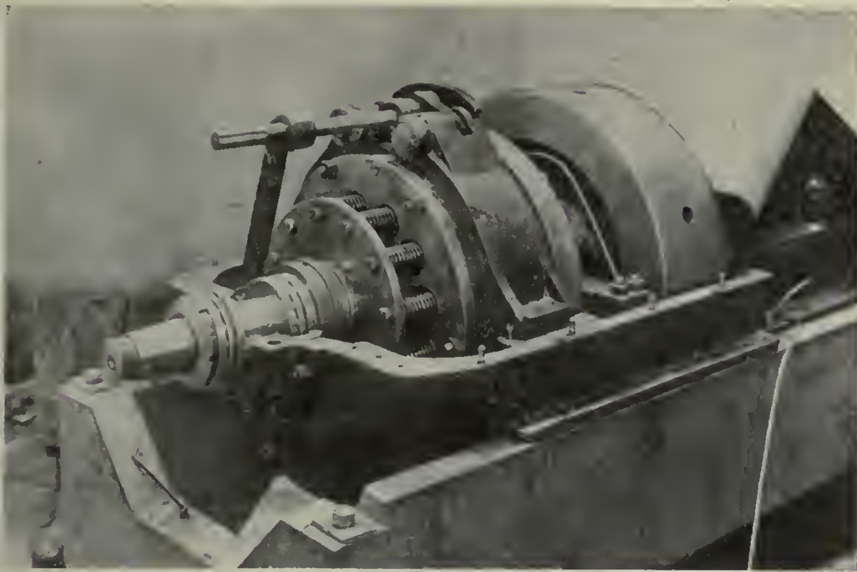
Ball bearings have been mounted on high speed propeller shafts. The propeller pressure is carried by two single thrust bearings with spherical washers; a double row radial bearing acts as a guide bearing. By suitable dimensioning of the centre sleeves, the bearing in its entirety becomes self-aligning around the centre of the radial bearing. In order to prevent the bearings from being thrown from their races by centrifugal force, a special cage is employed, consisting of a hardened and ground steel ring placed between two plate-iron discs which are riveted together.

Amongst the many advantages to be gained by using ball bearings for nautical machinery the following may be mentioned:



DIESEL ENGINE WITH BALL BEARING THRUST ARRANGEMENT.

DIESEL ENGINE WITH S K F THRUST BEARINGS FOR PROPELLOR THRUST.



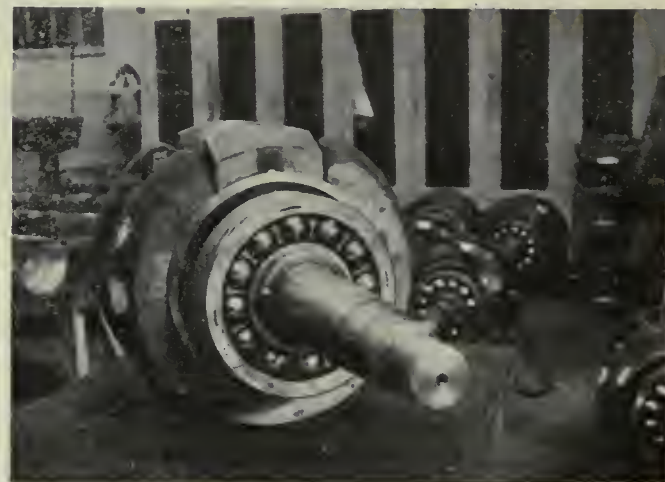
BALL BEARING ARRANGEMENT FOR TAKING THE THRUST OF THE PROPELLOR.

1. Exceedingly slight frictional resistance whilst running, which means saving in coal and the consequent enlargement of the radius of action.
2. Insignificant resistance when speeding up, making manoeuvring easier.
3. Great durability and length of life.
4. Accurate and lasting adjustment.
5. No overheating.
6. No wear on the shafts and bearing seatings.
7. Exceedingly reliable running.
8. Repairs and inspections easy and rapid.
9. Insignificant consumption of oil.
10. Easy to mount and unmount.
11. Great capabilities of self-alignment.

STEAM ENGINES FOR ROAD VEHICLES

By M. E.

The difficulty of obtaining liquid fuel of the lighter kind for road vehicles engaged on non-military work is compelling motor users to turn much more respectful attention than has hitherto been the case to the steam car working on solid fuel or heavy oils, and to the possibility of using gas in place of petrol as a fuel for existing car motors. The steam vehicle has always had, and was destined anyway to hold, its special place in the ranks of road vehicles, but in the circumstances of the hour its outlook has much improved, and efforts are being made to take full advantage of the situation. Among such efforts are the experiments that are being carried out with steam car and tractor engines designed on the uniflow principle.



S K F BALL BEARING ARRANGEMENT FOR THE MAIN SHAFT IN SINGLE CYLINDER CRUDE OIL ENGINE.

Stationary uniflow engines are now in fairly extensive use in this country, and have proved to be perhaps the most economical of all reciprocating steam engines for purposes covering a very wide field. The principle they embody is simple enough. The exhaust takes place through a ring of ports surrounding the middle of the cylinder, which are uncovered by the piston at the end of the stroke. To provide for this action the cylinder is made nearly double the length and the piston is unusually long, extending to nearly half the length of the cylinder. The gain from this arrangement arises partly from the simplicity of the engine, partly from the large exhaust-port area, partly from the fact that the direction of the steam-flow is not reversed, but, more than all, from the very favorable temperature conditions secured. Some modifications of the standard design have had to be introduced in applying the principle to road vehicles.

In the large stationary uniflow engines compression begins as soon as the piston has covered the exhaust ports. This is one of the fundamental thermodynamic principles of the engine, but it has been found necessary to moderate it for the high-speed non-condensing engine of the road vehicle by fitting an auxiliary exhaust valve which defers compression to a later stage in the stroke. The tests made thus far demonstrate that the poorest results obtained with the uniflow engine with saturated steam at 125 pounds are better than the best with any of the simple engines, even when operating condensing; that the steam consumption of the uniflow engine at 175 pounds with saturated steam, running non-condensing is lower than that of the compound non-condensing engine at 150 pounds, and the uniflow engine with steam at 180 pounds pressure and 130 degrees superheat gives a lower steam consumption than the compound condensing engine with 150 pounds pressure. These are striking and important results, portending developments which will improve a good deal the relative position of the steam vehicle.

ASSEMBLING SHOP SHOWING PART OF THE SHAFT. AND BALL BEARING ASSEMBLY.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

ALTERATIONS TO SHELL LATHE IMPROVE OPERATION MATERIALLY

By Jack Homewood.

THERE are probably few operations in the manufacture of munitions that will more thoroughly test the efficiency of a machine than that of rough turning the forging of the larger shells. During the elementary stages of the shell-making industry the majority of single purpose equipment were sufficiently heavy to take care of the duty required, but with the rapid progress made in production it was invariably found that certain portions of the first machines had to be considerably strengthened to withstand the heavy cuts and continual service.

While the changes here illustrated and described might well apply to any make of lathe, the improvements were made on one of the original types of rough turning heavy duty lathes. Recent modifications, however, have incorporated many advantageous features in this and other makes of machines over those adopted in the earlier equipment.

Under the piece work system of production few operators give serious consideration to the machine itself, the first thought invariably being the "eight cents per shell," or whatever the price may be. This appears to be an unavoidable trait of human nature, but one that must receive the attention of the tool builder when designing a machine, especially for work of this character, so that it will stand up to the highest usage and abuse, thus providing a mechanical defense for the vagaries of the human element.

To maintain axial alignment of the shell during the operation of rough turning, it is necessary to exert considerable pressure at the centers to avoid the shell "backing away" and varying the gauge dimension. To meet this excessive thrust pressure on the headstock bearings and eliminate undue friction many lathes are provided with ball thrust bearings.

In this particular instance the ½-inch ball race on the front bearing was found to be too light for the heavy duty, the race showing excessive wear, together with ball breakage. To overcome this trouble the thrust was replaced with one of ⅝-inch dimension, the race rings being made from material from the forgings of 9.2 inch shells. To reduce the possibilities of further trouble an additional ball thrust bearing was placed at the rear, using ½-inch balls and an adjustable nut, as shown in Fig. 2.

The irregularity of the cut on eccentric shells was a very serious factor, as the stress imposed was frequently so great as to break off the quill or tail stock spindle, and in one instance break-

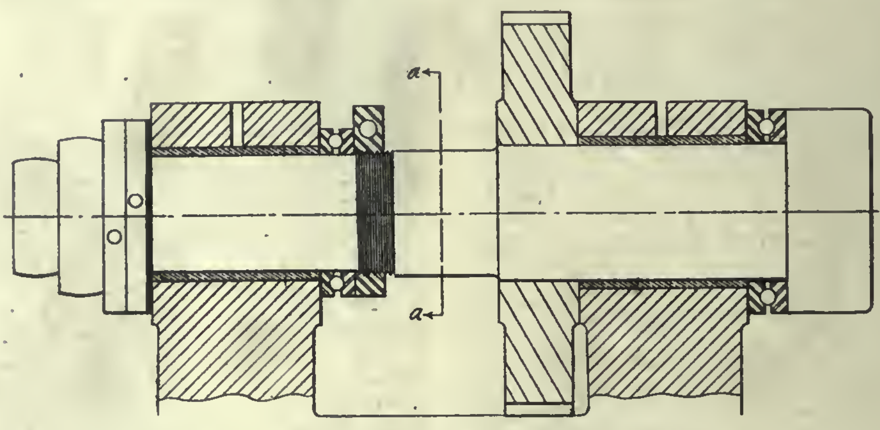


FIG. 1—THRUST ALTERATIONS TO HEADSTOCK.

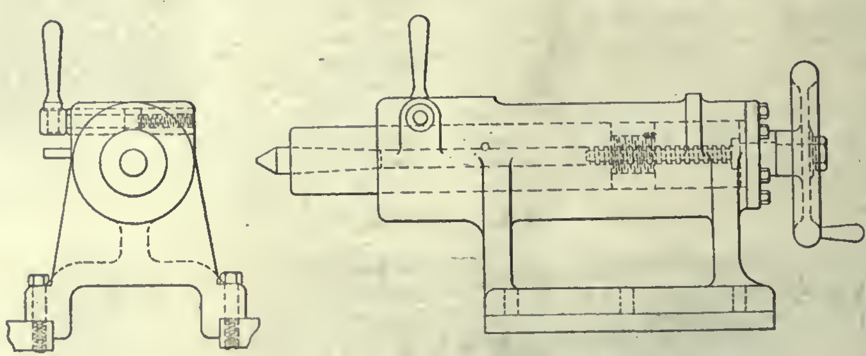


FIG. 3—INCREASING THE RIGIDITY OF THE TAIL STOCK.

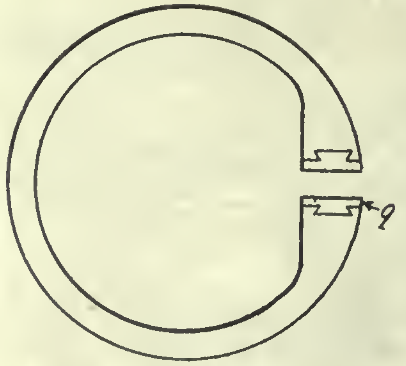


FIG. 2—VIEW OF THRUST NUT SHOWN AT AA.

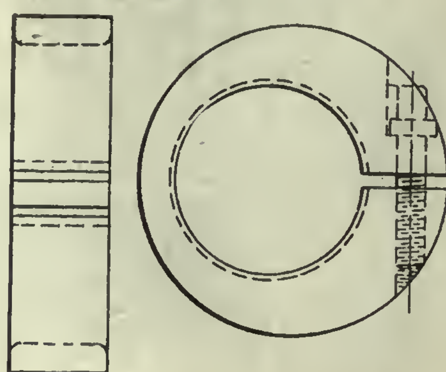


FIG. 4—CLUTCH EXPANSION RING.

ing off a portion of the supporting casting. To meet these objections the spindle was made of steel, 3 15-16 inches diameter in place of 2 15-16 inches, and the extension on the tailstock was made 7 inches in diameter and 6 inches long, against 5 inches by 3 inches in length. The tailstock was also made longer and secured in a fixed position by 6¾ inch cap-screws, three on either side. Greater thrust leverage was provided by adopting a heavier and larger handwheel.

Improvements were also made to the driving clutch ring as shown in Fig. A, the wearing surfaces being fitted with case-hardened blocks dovetailed into the expansion ring. The expansion pin was also case-hardened. Increased rigidity was given to the worm on the feed shaft by placing a supporting bracket in front and in contact with the worm. These several improvements added greatly to the life and efficiency of the machine.

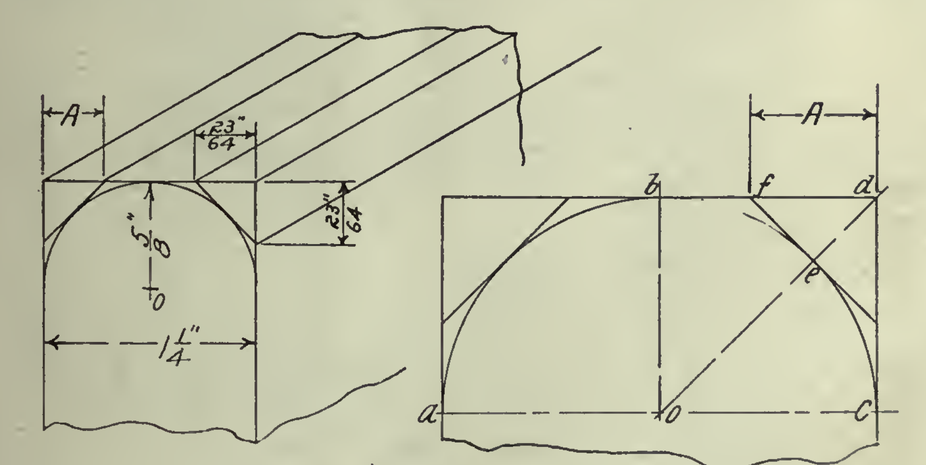
TABLE FOR ROUNDING CORNERS
BY J. W. BROADBENT

Pattern makers are frequently called upon to round off the edge of a strip to form a semi-circular cross section as shown in the sketch. On the larger pieces it is often desirable to saw strips off before finishing with the smoothing plane. To facilitate the laying off of this work the accompanying table has been prepared, giving the dimension A to be marked off from each corner so that the line b-c will be tangent to the arc required. The constants here shown are derived from the solution of right triangles, and an explanation of this might be of assistance for the solving of similar problems. In the small sketch the arc a-b-c is the one required. Suppose this is to have a diameter of 7½ inches, then the distance o-b—shown on the table with the integral number at the top and the fraction in the left hand column—will be ¾ inches. The distance o-d will be the square root of the sum of the squares of o-b and o-c, or expressed in the form of a formula o-d= $\sqrt{[(o\text{-}b)^2+(o\text{-}c)^2]}=\sqrt{[(3.75+3.75)]}=5.303$ inches. Then the distance d-c will be (o-d)—(o-3)=5.303—3.75=1.553 inches. The distance A desired will then form the hypotenuse of the right triangle d-c-f.

Again d-f = $\sqrt{[(c\text{-}f)^2+(c\text{-}d)^2]}=\sqrt{[1.533+1.553^2]}=2.196$ inches. This dimension to the nearest 64th will be 2 12-64 or 2 3-16 inches.

Table for Rounding Corners.

		1	2	3
		37/64	1-11/64	1-49/64
⅛	5/64	21/64	1-1/4	1-53/64
¼	9/64	47/64	1- 5/16	1-29/32
⅜	7/32	51/64	1-13/32	1-31/64
½	9/32	7/8	1-15/32	2-3/64
⅝	23/64	61/64	1-35/64	2-1/8
¾	7/16	1-1/32	1-5/8	2-8/16
⅞	33/64	1-3/32	1-45/64	2-17/61



METHOD OF ROUNDING OFF CORNERS

LOSS DUE TO SOOT

Soot, as is well known, is a bad conductor of heat. The loss of heat conductively in a boiler due to this is calculated as 9.5 per cent. for soot layer one-thirty-second of an inch thick; 26 per cent. for double that thickness; 45 per cent. if the layer is one-eighth of an inch thick, and 69 per cent. of it if three-sixteenths of an inch thick.

REMOVAL OF OIL FROM FEED WATER

The majority of the reported cases of boiler bagging are due to the presence of scale or oil in the boiler. The removal of the former may be accomplished by what has been termed the "periodical clean" method—that is to say by the use of mechanical cleaning methods each time the boiler is opened for inspection, by the introduction of boiler compounds, or by treating the feed water chemically. No amount of chemical treatment will remove oil from feed-water, however, and some mechanical filtering process must be relied upon for its elimination. Some engineers favor cloth filters and some sawdust, sand, or other substances, but most depends upon the design of the filter itself, and individual manufacturers of these apparatus may be relied upon to adopt the filtering medium which is best suited to their own construction.

With regard to the comparative harmful properties of various oils, the most dangerous bags and blisters are generally caused by animal and vegetable compounds, with or without the additional presence of scale. Attempts to boil them out with soda or some alkali are to be severely condemned as rendering the oils more dangerous still. As has been stated no amount of boiler compound can counteract the ill-effects of oil entrained in feed water, it being imperative that some external mechanical means be adopted when it is present.

CHART SHOWING CHIMNEY LOSSES

THIS handy chart has been developed by the Uehling Instrument Co., 71 Broadway, New York, and it is of interest and value at the present time when the coal problem is so important, for it enables anyone to quickly and closely estimate the money now being lost up almost any chimney due to low CO_2.

Simply connect the percentage of CO_2 (shown in column C) with the money now being spent per year for coal (shown in column A), and the intersection of the connecting line with column B immediately gives the dollars rolling out of the chimney in the form of heated gases.

Example: If $20,000 is spent per year for coal burned in a furnace whose average CO_2 registers 9.3 per cent., what is the approximate money lost up the chimney per year?

Solution: Connect the $20,000 (column A) with the 9.3 per cent. (column C), as indicated by the dotted line drawn across this chart, and the intersection with column B shows the approximate yearly loss to be $5,000.

The object of this chart is to show that a high percentage of CO_2 is most desirable. To be sure, even where the CO_2 is as high as 21 per cent. the theoretical maximum there is a loss, because in the average power plant the flue gases leaving the boiler have a temperature as high as 500° or 600° F. Loss, therefore, is inevitable unless a blower is used for exhausting the gases, and some sort of interchange system is installed for either heating the feed water or preheating air and leading it under the grate.

It is significant that most of the large power plants of to-day have adopted CO_2 instruments that record automatically and continuously. The reason for this is to keep constant tab on the workers in the boiler room and the efficiency of combustion. The recorder may be placed at any convenient distance from the boiler, in the office of the chief engineer, owner, manager or superintendent, while an auxiliary CO_2 indicator is placed on the boiler front in full view of the fireman. The function of the indicator is to keep the fireman constantly informed as to the efficiency of his own work. This feature is most commendable.

Coal cannot be saved by a CO_2 machine alone. If no attention is paid to the indicator or recorder, the installation of such apparatus borders on foolishness. The records should be carefully watched and studied, and adjustments should constantly be made in firing methods until the best percentage of CO 2 is obtained. After the best mark is reached, fluctuation of the CO 2 line below that mark to any great extent should not be allowed.

This chart is based on a flue gas temperature of 600° F., and an outside air temperature of 60° F. Where the flue gas temperature is higher, or the outside air temperature lower, the money loss will be correspondingly increased. On the other hand, with a higher outside air temperature and a lower flue gas temperature, the money loss is proportionately decreased. Further, in the construction of this chart it has been assumed that the coal has a calorific value of 14,500 B.t.u. per lb. of combustible.

It may also be interesting to point out that where there is only 3 per cent. of CO 2 in the flue gases 76 per cent. of the heat value of the coal passes up the chimney as waste under the conditions outlined above. It is impossible, however, for these gases to contain as low as 2 per cent., because it would require more than the original quantity of heat in the coal to heat the enormous surplus of air to a temperature of 600° F.

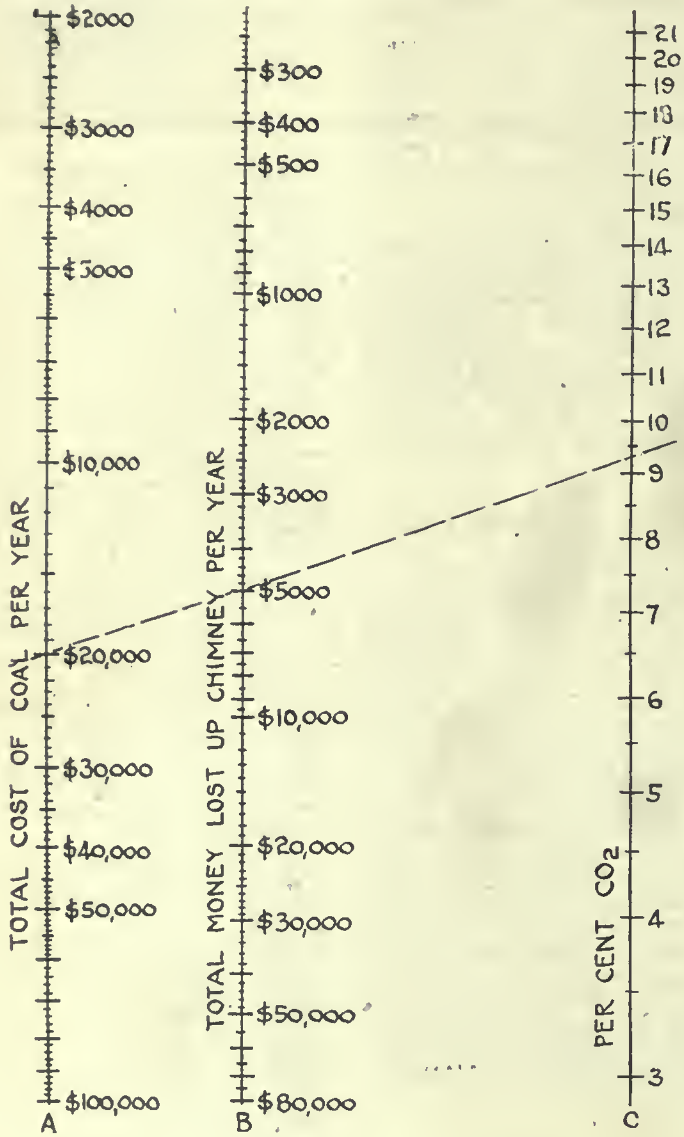


CHART SHOWING CHIMNEY LOSSES

COMPOSITE SHIP CONSTRUCTION

By Mark Meredith.

THERE has always existed a considerable amount of speculation as to what characteristics are peculiar to the method of ship construction known as the composite" method, and this term is peculiarly applied to those ships where the vessels are framed internally with metal and planked with wood. The invention of composite shipbuilding is usually ascribed to John Jordon, a member of the firm of L. H. McIntyre & Co., who were shipbuilders in Liverpool in the early days of 1840. He obtained a patent for this method of ship construction, and in 1850 the McIntyres built the schooner "Excelsior" upon this principle, and the barque "Marion McIntyre" in 1851, these being the first composite vessels ever constructed. However, Jordon's system did not attract much attention until the year 1863, when a number of British clipper ships were built for the China tea trade. There were the "Taoping," built by Robert Steele & Sons; "Eliza Shaw," by Alexander Stephen, and "Yang-tze" and "Black Prince," by Alexander Hall. These four ships gave such good account of themselves that from that time onwards all tea clippers were composite built, although it was not until 1867 that the committee of Lloyd's Register issued the first rules for composite construction.

This method of ship construction was also used for naval vessels, and during the period 1870 to 1880 a number of sloops and light cruisers were put into commission for the British Navy, and there are in the service of the United States Navy to-day the composite-built gunboats "Paducah," "Marietta," "Wheeling," "Princeton," and "Annapolis," which were completed between the years 1896 and 1904. These vessels were intended for service in tropical waters, where fouling of the bottom is very extensive, and here the advantage of composite construction was shown to be great.

In Jordon's system of building composite ships the whole outer skin, including keel, stem, stern-post and planking, is of wood, arranged as in the skin of an ordinary wooden ship, and the framework of the inside of the skin, including beams, frames, kelsons, stringers, shelf-pieces, waterways, hooks, transoms, diagonal braces, etc., is of iron, arranged almost the same as in an ordinary iron ship, channel, or trough-shaped iron being used for the frames. The bolts which fasten the skin to the frames are of iron, generally galvanized or coated with zinc, and their outer ends are countersunk in holes of such a depth that the iron bolts can be electrically insulated from the copper sheathing by plugging the holes with pitch or some other suitable non-conductor of electricity. But this system made it very difficult to keep a vessel perfectly tight. Therefore, McLain proposed that to keep the leakage free from the iron of the structure vessels should be built as regards keel, stem, stern-post frame and outer planking the same as those of an ordinary wooden vessel; but instead of the ceiling and inside the planking being composed of wood, it was to be constructed of iron, united all round at the bottom and ends of the vessel, and made thoroughly watertight, forming a complete inner skin, with beams, stringers, keelsons, bulkheads, platforms, etc., also of iron. The greater part of the wooden frame was merely of dimensions sufficient for bolting the wooden planking to, and was inserted between the iron frames riveted all round the outside of the iron ceiling. The wooden frames were fastened to the iron frames by galvanized iron fore-and-aft bolts, either screwed or plain. The wooden floorings were made deep in the throat and stiffened with plates on each side, riveted to the angle-iron frames, or iron floors were fitted inside the iron ceiling to supply the requisite transverse strength. The apron, innerpost and deadweight were inserted between and bolted to large angle-iron riveted on the iron ceiling. The outer planking within the influences of the copper sheeting was fastened to the wooden frame with screw tree-nails, or with yellow metal bolts. This system of building composite ships was intended chiefly for armor-clad war vessels.

DEVELOPMENTS IN SHOP EQUIPMENT

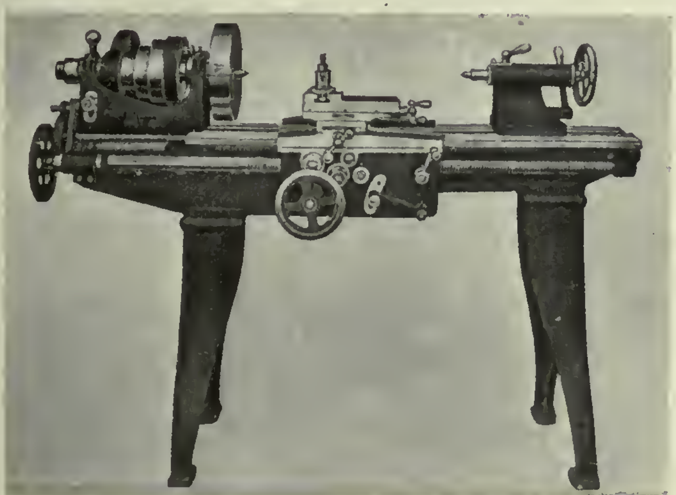
Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

SCREW CUTTING ENGINE LATHE WITH GAP

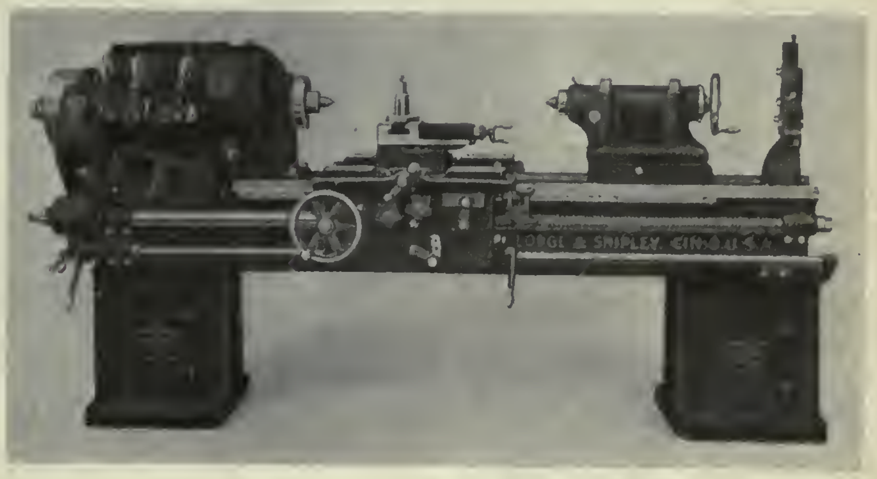
THE screw-cutting engine lathe illustrated herewith has been brought out by the Perfect Machine Co., Galt, to fill the need of a high-grade machine for manufacturing plants making light parts and for experimental purposes.

The headstock is of very rigid design and has a three-step cone pulley and back gears giving six spindle speeds. The spindle is forged of high carbon steel, is accurately ground and is hollow for bar work. Both bearings have split bronze bushings, providing an easy and effective way to take up wear. The end-thrust of the spindle is sustained by a screw collar. A carriage reversing mechanism for screw cutting is located in the headstock.

The leadscrew is made of high carbon steel and is very carefully cut. The threads of the leadscrew are never in use except when the lathe is cutting screws. For ordinary work an automatic friction feed driven by a spline in the leadscrew is provided. By shifting a spring lever on the outside of the apron an instantaneous reversing of the carriage is obtained. Automatic longitudinal and crossfeeds are engaged by turning knobs. The crank handle for the hand feed does not revolve while the automatic feed is working. An absolutely reliable safety device prevents the engaging of either longitudinal or cross-feed friction mechanism, while the half nuts for the screw cutting are closed.



SCCREW CUTTING ENGINE LATHE



20 IN. SELECTIVE HEAD LATHE.

20 IN. SELECTIVE HEAD LATHE

The accompanying illustration shows the Lodge and Shipley 20 in. selective head lathe featured by the Garlock Walker Co., Toronto, at Toronto Exhibition.

In the design of this lathe considerable care and effort have been expended in the design of the selective head. The sliding gears on the initial transmission shaft are mounted on a driving sleeve having four integral keys. All other shaft-driven gears are pressed and keyed to shafts. All shaft bearings are in the main headstock casting. This casting has box sections with sides extended up to the center line of the spindle, which makes an unusually rigid casting. All transmission gears are chrome nickel steel, heat treated. The face gear is of steel. A rigid casting bolted to the headstock supports the driving pulley and thus relieves the driving mechanism of all belt pull. Inside the supporting casting is a powerful cone friction. Pulley is regularly equipped with a brake which allows spindle to be stopped quickly.

The spindle has a double nose cut from the solid. The outer nose or cup is threaded internally to hold the face plate in position, and the end is faced to provide a very large diameter shoulder, against which the face plate is tightened. The inner nose is cylindrical, left blank and extends beyond the outer nose, so as to form a pilot to receive the face plate or chuck plate. This pilot at all times accurately centers the chuck plate, and by centering the bore of the chuck plate before the threaded portion is reached, insures that the threads engage easily and that the chuck plate may be readily drawn squarely against the face of the outer nose.

At the right hand of the apron within easy reach of the operator is a lever which controls the clutch and braking mechanism. An additional lever directly beneath the headstock is also attached to the same shaft on which the apron control lever is mounted. A slight upward motion of the lever throws in the clutch. A slight downward motion and the brake stops the lathe, or if the lathe has been ordered with reverse, the same downward motion of the control lever will reverse the direction of the spindle.

To prevent wearing the bed hollow near the head when the lathe is used for short work, all beds are made with chilled ways. The carriage is of good cast iron, but the bed is so much harder than the carriage that the wear comes on the carriage instead of the bed. Even though the carriage should become worn after several years' use, the bed will still retain its alignment.

The bed is of such depth and width as to give the greatest rigidity under heavy cuts. It is strongly braced internally by cross girths. The surfaces to which the lead screw bearings are fastened are planed to receive them; the bearing blocks are tongued into a groove planed in the bed, thus securing accurate and permanent alignment. The V's are large and the tops are rounded by grinding to prevent bruising. The surfaces between the V's are ground. At the rear end the bed is cut away to allow the overhang or quick removal of tailstock or turret. The feed rack is of high carbon steel, and, except on long beds, is in one piece. The horizontal and vertical surfaces of the inner side of the front shear are scraped bearings. This is used as a supplementary bearing for the carriage.

The carriage has an oil trough around the front and rear V's. This prevents the lubricant from running down over the apron. The carriage takes a right angled bearing on the inner horizontal and vertical surfaces of the bed directly in line with the tool thrust. This supplementary bearing greatly shortens the span of the carriage from the front V to the rear V, and gives a solid support to the bridge.

The tailstock is rigidly braced internally to withstand heavy cuts. It is so shaped that the compound rest can be swiveled to 90 degrees when using the tool on small diameters. It is clamped to the bed by locking bolts operated at the top of the barrel. The base is graduated for set-over. The spindle is of annealed tool steel. A plug clamp locks it in correct alignment and does away with the split barrel.

Quick change gears are of steel and are of such strength that feed changes can be made while the lathe is under a cut. The cone of gears is mounted between the walls of the bed directly under the headstock, solidly supported and away from all dirt and chips. There is no possible way for any of the bearings to twist or give when under a heavy cut. There are no gears with a great overhang. All studs are firmly supported.

The lead screw is of high carbon turned and ground stock, chased to a standard size. The lead screw passes through the double bevel gear sleeve and engages it by a key and spline. This key extends almost to the full length of the bevel gear sleeve, and the long bearing prevents any cramping action in the spline. The half-nuts are chased from the solid and then split. The threads of the lead screw are never in use except when the lathe is cutting threads. Lead screw has outside thrust at both ends opposed by high grade bronze washers.

INDICATING DIAL SCALE

AUTOMATIC DIAL INDICATING SCALES

The Toledo Scale Company, Toronto, have recently brought out a new industrial scale which is capable of weighing up to twelve thousand pounds. This scale as seen in the accompanying illustration has a large, easily read dial which is graduated up to two thousand pounds and when the heavier weights are to be weighed, instead of adding weights to the beam by hand, an automatic mechanism places the weights on the beam pan by the shifting of a lever. At the same time the weight in pounds which is to be added to the dial indication appears in large characters in a window on the dial face. This unit weight arrangement adds greatly to the sensitiveness of the scale, the dial indications reading to a small figure.

Tare beams are also provided and if for any reason hand weighing is desired it is accomplished by unhooking the dial mechanism, placing the weights in an auxiliary scale pan and proceeding as usual in hand weighing. The scale platform is not limited in any way to any one fixed dimension, but may readily be adapted to any condition likely to be encountered in practice. Industrial tracks may be readily used.

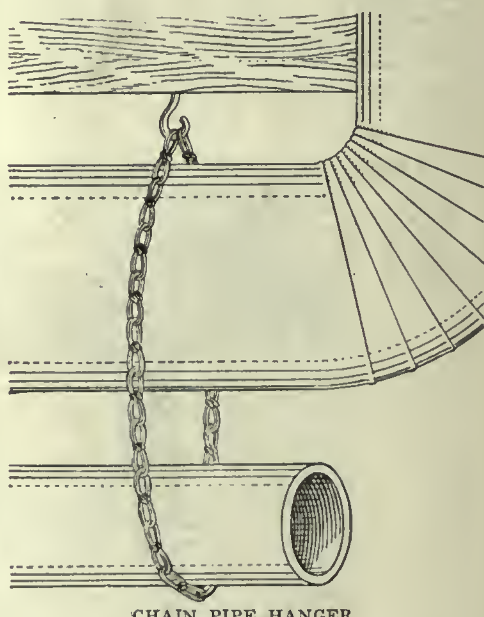
CHAIN FOR HANGING PIPE

The common method of supporting pipe has many difficulties which are very evident to any one who has had any experience in this line of work. The demand for better methods of hanging pipe has resulted in the development of a special chain for this purpose manufactured by the Cleveland Galvanizing Works, Cleveland, Ohio.

Bull Dog chain, as it is called, is more economical than other pipe hangers. It is furnished in reels from which the desired lengths can be cut as required. There is no waste which must be cut off as is the case with other hangers. This chain used as a pipe hanger is quickly and easily placed in position, the screw eye is screwed into the ceiling or beam above the pipe and the chain, having been cut to approximately the desired length, is looped around the pipe and both ends of the chain are slipped onto the hook of the screw eye as shown in the accompanying illustration. The steel from which these chains are made is the finest quality cold rolled steel wire. The links are formed with a special tie which cannot pull out.

It will be seen that the use of chain for hanging pipe offers several advantages. By moving the chain and simply tightening or loosening the screw eye the level of the pipe can be raised or lowered any desired distance. Larger adjustments can be made by drawing in or leaving out additional links. Where there is liability of considerable change being necessary it is advisable to make the chain several links longer than the desired length.

The extreme flexibility of the chain greatly facilitates the making of horizontal adjustment. This is found of great benefit when it is desired to shift the position of the pipe as it does away with the use of cross pieces to which the



CHAIN PIPE HANGER

hanger is fastened through the extreme flexibility of the chain allowing the pipe to be removed several inches without making any change in the length of the chain and without shifting the location of the screw eye.

TIMBER FOR AEROPLANES

By M. E.

WITHOUT going so far as to be in absolute agreement with those who believe that aeroplanes of the largest size can be best constructed almost entirely of timber, it is a safe prediction that the machines composing the air fleets of the future will continue to use a large percentage of wood.

Timber Resources Unclassified

Much, however, remains to be done before any real progress in this direction can be made as not only is our knowledge of the properties of timber from the standpoint of the engineer and aeroplane designer in the most elementary phase, but there are still only the vaguest kind of notions as to home and Empire sources in timber supplies of the right kind. While the Geological Survey has made a close investigation of the raw materials of the steel industry and supplies of ore, fuel and refractory materials from home sources have been carefully calculated and classified, the tabulation of timber as a raw material of industry has received little or no attention in Great Britain, and statistics dealing with the quantities of different classes of timber available, or even with the location of the varieties suitable for definite purposes are practically non-existent.

The needs of the war have accentuated our deficiencies in this respect. With a heavy call upon the steel and metal trade generally for materials for munitions and shipbuilding, it became necessary not merely to use timber for all purposes to which it has been commonly been applied, but to substitute it wherever possible for steel. None of the new demands for timber have been more important than that emanating from the aeroplane industry, and it is a tribute to our national facility to get out of a tight place and to muddle through somehow, that in the absence until recently of any department whose business it was to co-ordinate supplies with manufacturing requirements the needs of the industry should have been met as well as has been the case. We know that in Germany where the craze for organization has permeated the national fabric, and is sometimes a blight, although more generally a stimulus to industrial enterprise, that the timber resources of the Empire had, in the years before the war been tabulated, ticketed, and docketed with the utmost minuteness, and the available quantities of timber for many purposes, but particularly those required for aeroplane construction measured almost down to the square foot. The result was that the outbreak of war and the early revelation of the importance of the air arm found the enemy prepared with precise knowledge of the quantities and varieties of timher which could be provided for aeroplane work, while we in this countrv were almost in the dark, hoping and believing that supplies could be obtained by relying very largely on supplies from overseas which, with the constant depletion of merchant tonnage became even more and more difficult to obtain. It was only indeed at the eleventh hour, and under the pressure of circumstances that we began to draw on our resources and discovered the general ignorance which prevailed as to extent and character.

The want of precise knowledge of the mechanical properties of timber is, altogether apart from the question of supplies, one reason why the engineer has been inclined to shut timber wherever possible out of his specifications in favor of steel, or any other metals, the investigation of mechanical properties of which has attracted a thousand investigators and has resulted in spite of gaps of knowledge in certain directions in the production of formulae which have enabled the engineer to use the material with an assurance of behaviour under particular conditions of service. In the case of timber he either rejects it altogether or employs factors of safety on the very high side. The need of investigating the mechanical properties of a neglected material is the more necessary when it is remembered how extensive is th field to be covered. Mr. Barling did not exaggerate the case when he reminded the Aeronautical Society in his recent contribution that whereas here may be about 100 metals and their alloys in fairly general use, there are at least 1,000 different kinds of wood on the commercial market.

Little Research Work Done

During recent years, except perhaps in Germany, there has been little or no research work in the engineering properties of timber worthy of the name. It is necessary to go back for nearly a century to find the records of any exhaustive work on the subject. Wertheim and his colleague Chavandier—both Frenchmen—examined the mechanical properties of European timber in detail, and the main conclusions at which they arrived, and which have been confirmed by repeat experiments, form the basis of our present knowledge of the mechanical properties of engineering timber. One broad conclusion emerges from the mass of experiments then conducted; it is that the law of strength being proportional to density holds good over a very wide range if account be taken of the wetness. Wertheim and Chavandier went into this factor somewhat fully, and their work showed quite clearly the decline of density with dryness, and the associated rise of elastic modulus, and the natural drop in elongation as the percentage of wetness is diminished.

Effect of Moisture

There are critical points affecting these properties which need to be carefully investigated, but it would seem that the limiting range to give maximum tenacity is 10 per cent. of moisture. With higher percentages there is a fall in tenacity, and with increased dryness brittleness is induced. On the effect of distance from the centre of tree on mechanical properties, Wertheim found that these increased in regular ratio in passing from the centre toward the circumference. The gain in strength varies with different timber; the increase with radius is perhaps at its highest in the coniferous woods, while in the case of oak and birch the mechanical properties are at their maximum in specimens taken from a point at about one-third of the outside radius, while in beech much depends on the age of the tree from which the test piece has been taken. Then there is the effect of height of tree, and as might be anticipated there is a gradual decline in mechanical properties in passing upwards from the base. The influence of soil and situation was also investigated by these early workers.

General Applications Possible

It is quite obvious, however, that while some general applications can be made from these broad conclusions, much recent knowledge of the properties of timbers, and particularly those used in aeroplane construction have had to be derived from a process of trial and error, and in the midst of the distraction of a great war and an intense pressure for delivery of machines. The trouble is that there are great practical difficulties arising from the material difference in behaviour of woods, depending on the direction in which the twist is made, and although perhaps the figure of variation, 600 per cent. for the same timber, given by Prof. Groom is rather a bogey maximum than anything else, it refers to a real difficulty which has confronted the industry. Additional knowledge is also required of the influence of the time factor as well as resistance to shock, for which it is necessary to devise a sound test.

One difficulty at the present time is that as was indicated by a recent discussion before the Aeronautical Society, a number of investigators are taking up the subject, but there is an obvious tendency to carry on the work in a series of watertight compartments. The existence of war conditions imposes the need of secrecy, and for this reason no reference has been made in this contribution to developments which are now in progress or to certain facts which are the direct outcome of experience. It is desired, however, to voice the demand which has been made for a co-ordinated scheme of state-aided research on the mechanical properties of an engineering material for which during the next few years there will, with the development of the aeroplane industry, be an enormous demand. It is also necessary to have a complete survey and classification of all the home grown timber applicable to the needs of the aircraft manufacturer. These are among the fundamental requirements of air industry and they are dominant needs of a nation which must, at all costs, secure the command of the air.

Using B. C. Timber.—Adaptability of British Columbia spruce for aeroplane work is shown by the fact that shipments east in one month now double the total from August, 1914, to January, 1918.

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A Fortune in Peterboro ! ! !

THE Peterboro *Examiner* has a reporter who is out to lift the load of debt off that city. He's probably heard the ratepayers kicking about taxes and the thing laid hold of him. He longed to be another Horatius at the bridge and sweep back the tax rate. So one day he heard of a pile of old tin cans on the outskirts of the city and the idea struck him square between the optics.

He hustled back to the office, stripped for action, and put the following past the editor. Just in passing it might be mentioned that the heading for the article was even stronger, and said: "A Fortune at the Incinerator—Scrap Tin Has Accumulated Ever Since the Building Was Opened." But here's the story:—

> "The city has acquired a little fortune from the cans and tinware which has been taken from the garbage at the incinerator. Tin cans, stove pipes, tin pots and pans, old boilers and anything made from tin can be seen at this heap at the rear of the incinerator. The tinware resembles a railway embankment, and extends from the incinerator nearly to the railroad tracks. As scrap tin has risen enormously in value the city should be able to realize a handsome sum from its sale. The pile has accumulated since the incinerator was established, none of it having been removed. Before the refuse is dumped into the holes leading to the fire the tinware is picked from it and loaded on wheelbarrows and taken to the tin dump. The tin is all on city property, but it will soon extend into other property unless it is soon removed or is built pyramid-like above the incinerator building."

Now this little yarn might have caused a bit of joy in the heart of Peterboro. The only thing wrong with it is that it's a mile and a quarter wide of the facts. We don't doubt for one minute that Peterboro has a dandy heap of tin cans, but we doubt very much if they will ever make a fortune out of them. If the *Examiner* reporter has any other opinion than that let him start and pick up the cans and sell them. His pay envelope would look like a bloomin' fortune by comparison to his returns from scrap tin. As a matter of fact scrap tin is not high. It is low now, and has been for some time. It sells to-day at $12 per ton and that price is for scrap tin plate. Old prices used to run up as high as $24 per ton. In those days the big demand was for the making of tetrachloride for weighting silk. That industry, which was largely centred in France, has been seriously interfered with on account of the war.

As a matter of fact tin cans are worth nothing at all. "I wouldn't say thank you for a whole train load of them," stated the largest scrap dealer in Toronto this morning when the question was asked by this paper.

So there's Peterboro's fortune all shot to pieces—a tin can tied to it, so to speak.

Bill Haywood in Jail Now

BIG Bill Haywood, leader of the I.W.W. in United States, has been sent to prison for twenty years, and a stiff fine has been imposed as well. Other lesser lights have gone down for lesser terms. The peculiar thing is that Haywood and those associated with him have been able to get away with their rubbish as long as they have and remain outside the prison gates. Of course, Haywood has been jailed a good many times. It is no new sensation to him to look at current events from behind the bars. But this time it looks as though Bill were in for a good long look, and by the time twenty years turn over there won't be much rumpus left in the carcass of said Bill.

Haywood is well known in Western Canada. In fact the Crow's Nest Pass district in the south of British Columbia, the towns along the foothills of the Rockies in Alberta, and all the district where socialism runs rampant, were the real stamping ground for Haywood. He's not altogether a pleasant chap to gaze upon. He's big, well developed, but has one optic that is badly damaged. But to meet the man off the stump is to get a shock. He is not the lawless tub-thumper any more. His voice is mild if anything, and he betrays nothing of the bravado or the apostle of blood and thunder that has made him famous. He accepts arrest in the very best spirit. In fact it would almost seem that he did so with a feeling of pity for the police, the law makers, and all and sundry who had anything to do with skidding him toward the cooler.

But allowing for all that, he's a better resident in jail than outside it. The one question that has never been satisfactorily answered is, "How did you get away with it all, Bill?" For certain it is that had the small fry of the land taken it upon themselves to make such a stink as Bill stirred up, the law would have had them as soon as the sheriff had time to pull on his knee boots and fasten his office tag on the lapel of his coat.

Pleasure Driving on Sunday

THE automobile owners of Canada did not stop driving their cars on Sunday last, although a request had been made to them asking for such action. Gasoline is urgently needed in very large quantities for military operations, and there are many essential purposes in this country now consuming a large amount of this fuel.

In United States the residents have shown their determination in war matters again. They have stopped Sunday driving. In fact one New York man met with a deluge of eggs that were hatched on last year's bushes because he persisted in driving for pleasure on Sunday.

Is it more necessary that Canadians shall have a good time on Sunday than that there shall be plenty of gasoline for military operations? It begins to look as though that were the view some of them took of the matter.

Get the picture in your mind of the Canadian boy who has been at the front for years. He's been in the trenches. He's gone over the top. He's been wounded, wet, tired and sick, and yet he stays with it.

And yet when the request is made to cut out Sunday driving at home for pleasure, you won't do it. You're some patriot, aren't you?

FLOATING war loans free of government taxation is wrong—in fact it is indefensible. It puts the government into immediate and unfair competition with investment money for industrial purposes. It's a bang in the eye for that good old principle of equal rights to all and special privileges to none.

Radical Change in Ship Construction Methods

ANOTHER application of the electric welding outfit is in welding ship hulls. A ship has been recently built in Great Britain in which rivetting has been largely dispensed with, and the joints made by electro-welding.

This opens up a field of wide possibilities once the difficulties of initial cost of electrodes and plant are overcome. In point of strength there should be no difficulty for the strength of a rivetted joint seldom exceeds 70% of the solid, and good welding can be at least as strong. For the outer skin of the ship, where plates overlap each other, this method of making a joint should be easier and better than rivetting and it dispenses with caulking. For plates on tank tops, it should be a quick and serviceable method, but for joining framing and intercostals, it would hardly seem as good as rivetting, the extra stiffening of the rivet heads being lost. In many of the large passenger ships of recent building, the rivet heads in the upper courses of plates, as high as the hurricane deck, have been left full as this materially decreases vibration by stiffening the plate.

For watertight bulkheads this method is very suitable, and wherever it can be employed it eliminates the marking off, boring and rivetting of plates which means an immense saving of labor, and it also saves the rough usage of the plates occasioned in drifting holes into alignment. It will be interesting to watch the further development of this latest improvement on our old methods.

We'll Need Help On This

AN order has been issued by Rear Admiral Wood, commanding the Boston naval district, the drift of which is that all letters sent out or official documents must bear the name of the writer typed as well as in ink.

The reason is plain. The official has come to recognize that the average signature of those who write letters or fill in documents is not legible.

In business correspondence the plain blind signature in ink has always been a hard hurdle to take. There are some men who seem determined that they shall write their names in such a way that the work of deciphering them will be a problem that will make lawyers dizzy and ordinary laymen clean, stark, staring mad.

There is on our desk at this moment a letter from some gent in Winnipeg. His paper is fine and there's a picture of a building on top. The whole thing smacks of quarter-cut oak, plate glass and office hours from 10 to 3.30.

And what he says isn't half bad either. He canters along at an easy style and performs like a chap who would buy silk hose and chocolates for his stenographer at Christmas.

But when his stenog. gets through at the end and shoves the paper across for his nibs to operate upon—good night!

He started strong and ended stronger. It looks like Creatore leading a crescendo or the head trombone player for Sousa in action up to his knees.

It may be that this Winnipeg friend of ours has a great big wad in the bank and is scared stiff that some slippery person will forge his name and drive a bung hole into his saving. If that's correct he's surely bamboozled all the check-raisers and forgers that ever camped west of the Great Lakes.

He's a dandy. No doubt he was a dandy at a run-hop-step-jump when he was young, and, we'll bet our meal ticket that he could stand on his head before he was six years old.

Our big problem just now is that we want to write this chap in answer to his "favor of the 27th," etc., but whether to send it to the street cleaning department, the Winnipeg bug house or the cattle yards—we'll be durned if we know what to do.

When you sign your name to anything, for the love of Mike, don't try to do a skirt dance or play the mouth organ at the same moment.

Mother's Holidays

FATHER had the rinky-kink, or some disease like that—he said it made him feel at times as dippy as a bat. He couldn't speed up with his work, he couldn't write or think—in fact, his whole anatomy was somewhat on the blink.

The doc. had told him to depart unto some mountain stream, where he could smoke his black cigars and meditate and dream.

So mother packed a trunk of duds, and with pity in her voice she bade a sobbing farewell to the husband of her choice.

Then Mary Ellen had the dumps, she couldn't go to sleep, she feared she might at any time collapse into a heap—the social season was a grind, it had been one grand slam, it left her with a broken heart and a busted diaphragm.

A specialist she went to see, he looked her in the eye, and told her to vamoose at once or camp at home and die.

So Mary Ellen had to have a trunk or two of frocks, to flounder by the sad sea waves or squat upon the rocks. So mother had another spell, it lasted quite a while, and bustled Mary Ellen off in stunningest of style.

Then Thomas Henry had a kink, he was the son and heir, and sawbones told him to depart and quit his work and care.

His summer rags were dusted off, his cream pants creased just so—and mother hustled round like sin to make him fit to go. At last he went to some resort that cost three bones a day, and mother hoped that he would be much strengthened by the stay.

And then it came to mother's turn when all the rest had fled—she didn't go away at all, but stayed at home instead.

She tended to the garden plot, sprayed water on the lawn, she worked until the sun went out and was 'round again at dawn.

She canned a hundred jars of fruit, made fifteen kinds of pickles, while those of poorer grit than she blew in the family nickels.—ARK.

ARE YOU ENTRENCHED?

MARKET DEVELOPMENTS

Business Moving in A Big Way In Canada

Several Buyers Have Left For Producing Points—Deliveries Have Been Made From Shops on 9.2 Orders—Ottawa's Newest Order Causes no Stir in Iron or Steel Market

CANADIAN buyers are "over the line" in goodly numbers this week. In some cases the quest is machine tools and supplies, in others it is the making of some better arrangement on the part of jobbers for the securing of mill deliveries on sheets, etc. As a matter of fact, business in Canada that has to do with the turning of wheels is good, and is going to continue so for some time to come.

There are big business houses in Montreal and Toronto that right now would be glad were Ottawa to rule out some of the business that is passing through their hands. They fear that the tremendous orders that are being placed will deplete their warehouse stocks to the point of exhaustion, and they realize that the chances of filling their floors again are very poor.

Some of the concerns that took on American 9.2 orders recently have already made their first deliveries. This is record time, and it was possible because the firms had been on the large shells before, and had simply to revert to it after finishing six-inch orders. A large amount of fuse orders are being turned out here on Washington specifications. The Canadian War Mission at the American capital is confident of having the shops of Canada kept working to capacity on good business.

The order from Ottawa that the War Trade Board would control the supply of iron and steel in Canada, and direct its disposition, is not new or alarming, and the trade is quite willing to accept any ruling along this line. As a matter of fact the steel industry and the pig iron, too, has been under the direction of Ottawa for some time. They have, according to their own statement, been working "in close touch with the authorities," which is another way of saying the same thing.

Tin has taken a rather spectacular drop. A few weeks ago it was heading for the $1.50 mark, and $1.25 was the trading point for some time. Sales were made this week around the $1 mark, and dealers seem to incline to the view that a lower level may be arrived at now that the decline has set in. They claim that deliveries are freer. As a matter of fact the price of tin has been largely a fictitious one, and manipulation rather than absolute circumstances has had much to do with the meteoric career of the selling point.

Reports from various foundry centres in the Dominion indicate that plants that are on war work or work that is considered necessary to the upkeeping of agricultural production are getting a fair supply of pig and scrap iron at current prices. On the other hand shops that have no rating in the eyes of the government are having a hard time of it in getting enough pig iron. They are using a mixture in which scrap figures on a fifty-fifty basis, and this is considered by experts to be a dangerous practice, as it is almost impossible to get results at that point unless the scrap pile has been well analyzed and sorted beforehand.

PRODUCTION CAN'T SIZE UP TO PROGRAM OF THE U.S. WAR BOARD

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., Sept. 12.—The constant reiteration by the War Industries Board of Statements of the amount of steel required and the amount likely to be made, showing a large deficit, must not be regarded as suggesting that there is any divergence of view between the board and the steel makers. The latter are fully convinced, and they have been ever since April or May. As noted in last report the board places the requirements for the half-year at not less than 23,000,000 tons, with the list constantly being added to, while it named the prospective production at 17,000,000 tons. That, of course, was on the conservative side. From all appearances at this centre of production, where such matters can be judged closely, prospects are that production will be between 18,000,000 and 19,000,000 tons, and it is even possible that the higher figure may, if circumstances prove especially favorable, be exceeded.

The shortage of steel is, as a matter of fact, reflected by the actual conditions in the steel trade as they may readily be observed, the mills being able to furnish at the present time very little steel for purposes not entitled to a high grade of precedence. The supply reaches farther down the list of sequences in some descriptions of steel than in others, and farther with some mills than with others making the same class of product, but there is an effort, of course, to iron out these irregularities.

The System of Working

Before making specific reference to the position of different mills it may be well to review briefly the system under which pig iron and steel products are distributed. First, priorities and preferences should be defined. A priority, or priority order, is simply a regular order, such as obtain in the trade at all times, but with a sequence designated. A preference, on the other hand, is simply a purpose. The "preference list" is a list of purposes, in sequence, for which material would be used if furnished. Originally priorities were given to orders only by the War Industries Board, a separate action being taken for each order. By the new system, established in July, "automatic priority" is provided, the buyer attaching the priority number to the order as he places it, being guided by specific instructions, his action being subject to review by the War Industries Board.

Learning the A B C

Priorities are divided into three general classes, AA, A and B, with sub-ority. Still lower come the preferences, over A-1, and B-7 over B-8, the last named being the lowest degree of priority. Still worer comes the preferences. No producer is permitted to ship for a mere preference purpose except he has provided for the filling of all priority orders by the respective dates attached to them, or to fill a given priority order until he has provided for all priority orders of a higher rating. The preferences are designated generally as Class C. There is a final class, Class D, which is steel (or pig iron) which would go for a purpose not entitled to preference. It can only be furnished when everything else has been taken care of, and a permit for each shipment over five tons must be secured from the Director of Steel Supply. There is a blanket permit for lots of five tons and under, but with the limitation that the producer must report all such shipments monthly with a certification of belief that they were "in the public interest." In existing circumstances Class D is practically a dead letter, but it is useful as rounding out the nomenclature and providing for contingencies.

A confused impression may result from the fact that purposes for which priority orders are issued are named on the preference list, which includes all war work, such as shells, aircraft, ships, etc. In speaking of deliveries "on the preference list" one really means not the whole preference list, but that which remains after the preference purposes that are also entitled to priority have had their priority ratings assigned them. whereby they are removed from the preference list, for actual practice, and given a higher place.

To get down to actual fact, there are some mills so situated at present that they can take care only of priorities AA and A, having no steel to spare even for Class B-1. Other mills are providing for all priorities in full down to and including B-3, but when they get to B-4 the supply runs out, there being less than enough to cover all B-4 orders. As that is the degree assigned to steel for replacement in jobbers' stocks of material shipped under priorities and preferences it is an important and large class. Such mills scheduled jobbers' August quotas but will not complete shipments for a few weeks yet, the September quotas being correspondingly delayed. There are few mills that have steel left after providing for all priorities, down to B-8.

Showing a Deficit

Thus it will be seen that few mills are able to ship steel on mere preference, and yet the preference purposes left after priorities are subtracted represent a large tonnage, and they are included in the War Industries Board's estimate of 23,000,000 net tons of finished rolled steel required for the present half year. In other words, the position of the steel mills, as disclosed by actual inspection of the classes of shipments they are making and can make in the next few weeks is in strict accord with the War Industries Board's estimates, showing a large deficit of steel.

While the deficit has been increasing steadily it may possibly be reduced in the next three or four months, because at the present time railroad requirements are exceptionally heavy. As the railroads began to function very well in the Spring, after their decided breakdown in the Winter, it was feasible to postpone their rehabilitation, against another Winter, in favor of more pressing steel requirements, but now this work must be rushed, though only, presumably, for say three months. Rail production is now very heavy in consequence, and the building of the 100,000 freight cars ordered a few months ago is being pushed, with prospects that all, or very nearly all, will be completed before the end of the year. This is despite the fact that large orders for 30-ton standard gauge cars, and for narrow gauge cars have lately been placed for the A. E. F., with many more required, and doubtless figuring in the 2,000,000 ton estimate. Some of these will have to go over into the new year.

Pig Iron Is Scarce

Production of pig iron in August was at the rate of 40,300,000 tons a year, against rates of 40,700,000 tons in July, 40,800,000 tons in June and 40,900,000 tons in May. The curtailment in the midsummer months, with their high humidity affecting the output of the individual furnace, was less than usually occurs. Considerably larger production is in prospect. The weather will be more favorable. Some furnaces will probaly be taken off ferromanganese and spiegeleisen, which are not scarce, and put back on pig iron, which is extremely scarce. The Fuel Administration is making strenuous efforts to have better coke made, as some furnaces have complained of quality and probably it will also be possible to make somewhat more coke.

Using the machinery of the Bureau of the Census the War Industries Board has undertaken an inventory of all the steel in the hands of manufacturing consumers. a questionnaire being sent out to about 40,000. Whether much of the steel can be utilized is a question on account of the thousands of forms in which it exists. Some time ago jobbers were required to report their stocks. Possibly some jobbing orders will be thrown to manufacturing consumers to be filled out of their stocks.

POINTS IN WEEK'S MARKETING NOTES

Toronto firms taking on 9.2 American contracts have begun to make deliveries.

A No. 2 fuse is being made in a Canadian plant now. The manufacture of fuse had been discontinued here for some time.

Steel jobbers in Canada are handling such large volumes of business that they have difficulty in replenishing warehouse stocks.

Canadian firms have many buyers at U.S. points at present looking for machinery with any possible promise of early delivery.

Scrap business is brisk at U. S. points and correspondingly poor in Canada.

The price of tin has dropped to $1.05. It has been selling in recent weeks as high as $1.35. The values were not real and figures below the dollar mark may be looked for. Pre-war prices used to run around 30 cents.

The War Industries Board of the United States places the requirements at 23,000,000 tons of steel for last half of 1918, while the best the furnaces can posibly do is 17,000,000 tons.

Large quantities of rails are now being rolled by U. S. mills.

More U. S. blast furnaces are to be turned over to pig iron production.

A THIRSTY JOB

WANDERING around the Toronto Exhibition grounds is a thirsty job. To be sure there are rows after rows where one can take his thirst and get it rubbed over with pink lemonade, or if the worst comes to the worst a stop can be made and the victim, horse fashion, can unhook his nose bag and gurgle over one of those ultra-sanitary fountains that sputter and spit at intervals all over the premises.

But all said and done, sight seeing and collecting samples of pressed hay in the form of breakfast food's a durn thirsty job.

And so it happened that a brawly Scot who wandered past the exhibit of the Canada Machinery Corporation had his eye pulled up on a glass that was cavorting up and down on the shaper that was operating there. The glass was there to show the rigidity of the machine and the evenness with which it operated.

The Scot watched the operation, noticed that the glass was not attacked by any one around the premises. He quietly nudged one of the C.M.C. men and poured into his ear:

"If yon glass wur full of Scotch whusky you'd hae to fill it oft'ner."

AUTO SHOP CAPACITY TURNS TO WAR ORDERS

Business Still on Very Large Scale—Big Government Undertaking Established in France

Special to CANADIAN MACHINERY.

NEW YORK, Sept. 12th.—Machinery makers have received several large contracts from ordnance shops and shell manufacturers in the last week. Large contracts are also pending for machines to be used in the manufacture of power equipment. Manufacturers supplying aircraft builders and motor manufacturers have received large orders within the last few days. Ship builders continue to place supplementary contracts and numerous small orders are being placed by automobile manufacturers, all of whom are preparing to use the full capacity of their shops on war work. Some of the larger makers of automobiles have placed heavy orders for shop equipment.

Big Plant in France

The Ordnance Bureau of the War Department has placed several million dollars' worth of machinery included in the recent estimates of $12,000,000 to $15,000,000 to be expended in equipping the great gun-relining plant in France. Included in the more recent purchases are monster planers, gun boring lathes and several large grinding machines; one of the latter to cost $100,000 has been placed with a New England manufacturer. The Amalgamated Machinery Corpp., of Chicago, is to construct a monster concrete metal planing machine having a bed 500 feet in length for planing the beds of the great gun-boring lathes to ship to France. These gun-boring lathes have a swing of 102 inches and are 85 to 200 feet in length; forty of these machines have been ordered by the Ordnance Bureau. The same company has large orders from other ordnance makers, including 186 shell making machines for the Neville Island Ordnance plant. To expedite work, the company is now building an addition 75 by 300 feet to one of its shops in which it will build planing machines. The Midvale Steel & Ordnance Co. has also placed additional orders for tools for its 16-inch howitzer plant at Nicetown, Pa.

List of 1,000 Tools

The Baldwin Locomotive Works put out inquiries for over 1,000 machine tools and 80 travelling cranes last week, but will not close contracts until Government approval has been obtained for the building of the plant as well as for the placing of orders for equipment.

The Bethlehem Shipbuilding Corp. continues to buy tools for its new yard at Alameda, Cal. The Newport News Shipbuilding and Drydock Co. and the Barber Asphalt Paving Co., Philadelphia, have completed purchases of machinery for the making of marine boilers. Ship yards in China that have received orders for ships from the United States Shipping Board have placed orders for twelve punching machines in this country. The Federal Shipbuilding Co. has launched another 9,600-ton Liberty ship and is still buying machine tools and other equipment. The Sun Shipbuilding Co., Chester, Pa., has bought more equipment for its repair shops. The American Shipbuilding Co. has closed on some of the tools in its recent list, including a 42-inch x 28 foot heavy duty engine lathe.

The United States Government is to purchase additional machinery for shipment to France, including eight turret lathes for the Engineer Depot. The Navy Department is inquiring for lathes, planers, turret lathes and pipe machines for the Puget Sound Navy Yard and for six turret lathes for the Boston Navy Yard. Bids will be received September 24th on a long list of tools for the Washington Navy Yard. A contract for a repair shop at the Brooklyn Navy Yard has been awarded to the Austin Co., Philadelphia, by the Navy Department. The same contractors will also build a munition plant at St. Louis for the Laclede Gas Co., which has undertaken the work for the Government; 1,500 tons of structural steel will be used. The plant which the Ordnance Department will build at Long Island City is temporarily held in abeyance; the estimated cost is $400,000. For another Government plant at Fairmount, West Virginia, inquiries have been put out for a bending roll and punching machines. Henry Ford & Son are receiving bids on machinery for the Hamilton, Ohio, tractor plant and it is understood that 400 machine tools will be purchased. A large lot of milling machines are wanted for the manufacture of bayonets.

PIG IRON DELIVERIES ARE FOR WAR WORKING PLANTS ENTIRELY

THE war news from the western front is closely coupled with the progress of the industrial world. As the enemy is driven back the efforts of the workers at home are redoubled to keep up the pressure. The makers of wire were cut 25 per cent. in raw material lately, and the chances are that they will get another reduction.

Whether there are good chances of success or not, the fact remains that makers of pig iron at many U. S. points are agitating for a higher price for their produce. They claim there is no money in the business at present rates. Although the production figures are showing an increase, they don't begin to keep pace with the demands that are made on the furnaces. Reports from U. S. centres are as follows:

Pittsburgh.—The demand for a higher price for pig iron is taking form here. Some of the owners of blast furnaces claim that they cannot go ahead and do business at present values. In one case it is reported that one firm is not buying more ore, and that after present stocks are exhausted the Government will be asked to come in and operate the business, and the owners go so far as to state that they will not ask for any profit on their business. They point by way of justification to higher wages, increases in freight rates and other higher charges that are rapidly coming to the fore.

Producers go so far as to claim that were higher prices granted the output of the furnaces could be increased any way from 50 to 70 per cent.

Philadelphia.—There has been some selling done for first half 1919 iron, but the volume of trade has not been as large as in other years. A bit of complaint is heard because some consumers get immediate shipment for certain work, while at the time they have stock in their yards.

Buffalo.—Very little business is being booked here. The trade seems to be thoroughly convinced that it is no use taking on business unless it is sanctioned by the Government, in which case they say the allocations will take care of the output of the furnaces.

Cleveland.—Many of the users here report that they are having difficulty in securing supplies of foundry iron, for the reason that so many of the stacks have been at work on basic. Certain northern producers are still booking orders for delivery in 1919 to war shops.

Chicago.—Melters here do not seem to consider that it is necessary to make contracts under the present system. Bookings made some time ago are being seriously interfered with by allocations made by the War Board on work that they consider of prior importance.

Cincinnati.—There has been a realignment of contracts in this district, made necessary by some of the shops that were not on essential contracts turning over to the manufacture of machine tool castings for war shops. There is very little trading between shops in supplies, as the policy of each place seems to be to conserve every pound in the yard.

St. Louis.—Pig iron is delivered in fair quantities to shops working on Government contracts. In fact there is no complaint from them. Stove manufacturers have gone heavily into the scrap market, but this source is getting to be as uncertain as the pig. This industry has not yet been given a rating.

CANADIANS DOING A LARGE BUSINESS

Working to Capacity Seems to Describe Present Activities in Many Directions

TORONTO.— Machinery business in Canada is still moving in large figures. There is quite an invasion going on now—a peaceful one—of United States machine tool centres, and the invading forces consist of dealers in machine tools from this side of the border. Not only so but dealers in sheets and plates are on the other side of the line in large numbers, as well as those who are selling high speed goods. They take everything they can secure on this side of the line, and want all they can get on the other. The Canadian War Mission at Washington is trying to keep closely in touch with the capacity of Canadian plants. The idea seems to be in United States to get production where it can be secured the quickest. There is not much encouragement given to opening up new munition factories now. There are a large number of them in existence, and often they are able to enlarge and increase output much more readily than by the opening of new plants.

Some of the contractors who are taking on 9.2 contracts for the Washington Government have been able to make their first deliveries. The manufacture of fuse (No. 2) is also being proceeded with again on U. S. order. The making of fuses had been discontinued in this country for some time, but is being revived on a fairly large scale.

In Narrow Limits

Jobbers in Canada are working in limits that are so narrow that they are impossible. There is a shortage of sheets in this country now that has not been known before in some time, and prices are coming along in sympathy with the situation, an advance of one cent per pound being noticed already. Several Canadian dealers are off to United States mill points now to see what they can do to protect their warehousing business. They have been working under the U. S. pledge in regard to war work for a time, but they are at a point now where they are getting very few deliveries from the rollers. As a matter of fact one of the largest dealers in the Dominion stated to CANADIAN MACHINERY to-day: "I wish some of the business that we put through would be shut down on by the authorities at Ottawa. If things keep on as they are at present, and if our chances for replacement are no better than at present, we are going to find ourselves unable to supply the customers that are working on real essential war contracts."

Priorities are demanded by some of the U. S. business on all orders coming to Canada, while as a matter of fact priorities are not required until they come to .120 sheets. Ottawa has a habit of telling dealers to get their customers to use thinner material, but the trouble is that this cannot be secured. Jobbers get a B-4 rating in many cases, and deliveries to that standing are none too good. Neither is there much prospect of better treatment in the immediate future.

Premier galvanized sheets are quoted to-day at $10.70 (28), while 10¾ oz. have advanced to $11. Black sheets are still selling at 8¼ c, but the chances seem to be against that figure lasting for much longer.

Business Quiet in Scrap

Conditions are much different here and at U. S. points regarding the scrap metal trade. Across the line there is a keen demand for almost every kind of material, and maximum prices are being paid with the commissions added. In this country the scrap metal market is suffering from fatigue or something closely akin to it. There is just a fair volume of trade moving, in some cases dealers buying offerings to protect their credit and market rather than from any desire to take the material into their yards with prospects for a quick sale.

Brisk Demand Now

Dealers in high speed and carbon tools are selling more to-day than they have been doing for some time past, in fact the sky seems to be the limit in some cases. Especially cutters and reamers are wanted. There has been no change in lists recently.

There has been an unusual call in a large way for tools for U. S. shops. In some cases auto plants have been ordered to get over on war work, and the making of the change means a large supply of special purpose machinery. And behind it all the element of haste always has to be taken into consideration.

Tin Drops Down

The trade has been watching for the price of tin to blow up for some days, and quotations out now show that it is nearing the $1 per pound mark. Although it is quoted at $1.05 there have been sales made at a lower figure. As a matter of fact the whole situation in regard to tin has been highly fictitious and unreal. Thirty cents a pound used to be a fair mark, and if a few weeks ago a person had wanted to buy in futures, the price would easily have run up to $1.50. The whole supply comes through England, and there has been more manipulation than real cause behind the increases. Deliveries are freer now and larger quantities are coming in. It would occasion no particular surprise were it to come to a more reasonable level yet in the near future.

FEW APPRENTICES AS MOLDERS; PROBLEMS OF THE FOUNDRY TRADE

FOUNDRY men are having problems of their own at present. They are in many cases short of material and there are not enough molders to go around. Scrap has been bought in larger quantities than usual, in fact in some cases a mixture is used in which almost fifty per cent. is scrap. To go past the 40 per cent. mark was usually considered dangerous. In fact for particular work good care has to be taken in selecting scrap at 40 per cent. mixture.

A good big supply of pig iron would be a very acceptable thing just now to the Canadian foundry trade, but instead of becoming more plentiful the supply of pig becomes more scarce, especially for plants that are not on war work. In fact it is simply a case of "old connections" that keeps some of the non-essential concerns supplied to the point of operation. There are cases where the War Trade Board at Ottawa has informed users that they cannot have a supply, and it looks as though there would be more of this sort of business.

Molders Are Scarce

Foundrymen have stated most persistently recently that the supply of molders was running out in Canada. This may be so, or it may not, but certain it is that if molders are still in the land they are not all in the molding shops. Not long ago a prominent manufacturer expressed the opinion to this paper that it was only a matter of time until the molding business passed into the hands of the foreigners.

What Foundrymen Say

Apparently the shops of the East are in no better condition than those of Ontario or the West. For instance, C. A. Lushy, secretary-treasurer of the Amherst Foundry Co., Amherst, N.S., states that, "We have considerable difficulty in getting pig iron but as we have been supplying a considerable amount of goods for the Reconstruction Committee at Halifax, which is government work, and we have also been supplying goods for use in barracks and different plants throughout the country which are manufacturing munitions, the government has allowed us to have a small percentage of pig iron compared to our normal requirements. We are using more scrap than usual and are getting so far good results. We use about 40 per cent. of scrap iron, but do not think that we could use a higher percentage without interfering with the quality of our goods."

The supply of molders is sufficient for the present, as this firm has, according to their statement, "a sufficient number of moulders to keep our foundry running under present conditions, but if we could secure all the pig iron that we could use we would require a large number of moulders above those that we now have. In regard to apprentices, we usually are able to get all that we require and we should think there should be no difficulty in finding apprentices for the moulding trade as moulders, as a class, are very well paid men. We, of course, in this part of the country, employ very little foreign labor, as our foreign population here is very small."

Another Maritime Report

T. McAvity & Sons, Ltd., of St. John, N.B., is another well known firm. They are able to secure supplies of raw material, being largely engaged on war work at present. In regard to the situation with molders G. C. McAvity states, "I fully agree that there is a growing

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	105 00	105 00
Spelter	11 00	11 00
Lead	10 50	10 00
Antimony	16 50	18 00
Aluminum	50 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 36

Standard Buttweld	Black	Galvanized
	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19
Standard Lapweld		
2 in.	29 97	36 45
2½ in.	45 05	55 28
3 in.	58 91	72 29
3½ in.	73 60	91 54
4 in.	87 20	108 45
4½ in.	99 06	123 82
5 in.	115 40	144 30
6 in.	149 80	187 20
7 in.	195 20	243 95
8L in.	205 00	256 25
8 in.	236 20	295 20
9 in.	282 90	353 25
10L in.	262 40	328 00
10 in.	337 80	422 30

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	25 00
No. 1 machine composition	23 00	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	8 00	8 50
Cast borings	10 00	12 00
Stove plate	30 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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..	$ 8 00	$ 8 25
Sheets, black, No. 10..	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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...	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	.26¼
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck..	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod..	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 44
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra..	21	Atlas	18½
Peerless	21	X Empire	17½
Grand	19¾	Ideal	17½
Superior	19¾	X press	16
X L C R	18½		

Colored.

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

Wool Packing.

Arrow	25	Anvil	16
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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

shortage of molders, although in this section of the country we have not yet seen very much of the foreign element as moulders, although it has been practically impossible to get any young men to serve as apprentices, which, of course, we think is more or less due to the fact that they can receive a great deal more money to-day from common laborers' work, not appreciating the future."

In Brantford Shops

Goold, Shapley & Muir Co., Ltd., Brantford, are using a 40 per cent. scrap mixture and are securing good results, working very largely just now on agricultural tractors. Regarding the number of molders, W. H. Whitaker, of the company, says that, "We have some difficulty in the securing of sufficient molders and usually our floors are running three and four behind on account of the scarcity of men. We have not yet employed foreigners in this department of our work as molders. There is some truth in the statement that few young men are offering as apprentices to the molder's trade."

In other Brantford shops a decided shortage of pig iron is reported, although a fair amount of sorted scrap is on hand and is being freely drawn from. In regard to apprentices, shops have few in the molding department. In fact there is a shortage in all trades. An official of the Waterous Engine Works Co. stated to this paper that, "As far as our experience has been, it is quite true there are no apprentices. Practically no apprentices are offering for any part of our factory."

RENEWING ORDERS STARTS NEW DRIVE

And Machine Tool Trade In Montreal Is Brisk as a Result

MONTREAL, Que., Sept. 9, 1918.—The influencing factor on the present industrial situation is the apparent scarcity of many lines of material required for maximum operations. The feature of Government control of nearly all the essentials of production eliminates the possibility of any pronounced fluctuations in price quotations, so that the market is one of available supply rather than that of supply and demand, the controlling factor of prices in normal times. The great problem at present is that of supplying the wants of the shipbuilders and carbuilders, the output of plates being inadequate to the trade requirements.

Uncertainty In Steel

The general situation throughout the steel industry is apparently identical with that prevailing for several months back, as the market is one virtually controlled by the War Trade Boards of this country and the States. With few exceptions the production of steel at the present time is devoted exclusively to war essentials, either directly or indirectly. In the opinion of some dealers, however, it is believed that the output of the mills is in excess of the actual requirements, as in some instances it is thought that specifications for steel are greater than the needs, the object, no doubt, being to make certain that the available supply will tend to a surplus rather than a shortage. This condition, it is felt, will eventually mean that stocks will be accumulated which will tend to develop a weaker market. Local warehouses are practically depleted of steel material suitable for shipbuilding or railroad work, and regulations prevent the dealers from acquiring a stock for transient business. The general market is quiet and dealers report no change in prices.

Metals Are Steady

Activity in metals continues in fair volume but without any special features. The demand is steady, but the market is virtually under War Board control so that the situation is one not likely to be influenced by domestic conditions. Little metal is available at the present time for other than essential requirements related to war needs. The demand for copper is quite active, but the control price maintains the market at a steady level. The supply of tin is more plentiful and the market is easier. The bulk of this metal, however, is applied either directly or indirectly for war purposes. Local dealers are quoting from \$1.05 to \$1.10 per lb. Spelter and lead are both firm and dealers are asking 11 cents and 10½ cents respectively. The demand for antimony is a little more active and the available supply is only sufficient to meet the immediate needs. Dealers here have advanced one cent and are quoting 16½ cents per lb. Aluminum is steady and firm at 50 cents per lb.

Machine Tools Active

The demand for shell making equipment is not heavy, but enquiries would indicate that business is still quite active. The probability that many shell contracts will be renewed has added to the likelihood of further trading in machine tools. Enquiry for general equipment is also active, but the buying is less pronounced.

Scrap Trade Quiet

Little of interest is taking place in the old material situation and dealers report a very quiet market. The trade is so controlled at present that dealers are reluctant to deal in small quantities as the cost of handling scrap under existing conditions is excessive in relation to the prevailing prices. It is sometimes necessary for dealers to turn down a sale owing to the prohibitive cost of haulage. The local market has remained practically unchanged in most lines of scrap, but car wheels and axles have advanced. Iron car wheels are now quoted at \$38, against \$26 of a few weeks ago. Wrought iron R. R. axles are also stronger, the prices asked ranging as high as \$40 per ton. Increased supply of machine shop turnings has created a weaker market, the current price of \$8 being a drop of \$1 per ton. Cast borings at \$10 show a decline of \$2 per ton. Stove plate has advanced from \$26 to \$30 per ton.

The market in heavy lead is not so active and dealers have reduced quotations to 7 cents per pound.

THE LOWLY SCRAP HEAP IS OCCUPYING A BIG PLACE NOW

THE scrap metal situation in United States is not much like the Canadian conditions. In American points the demand is keen and supplies are short. In the Dominion the very reverse seems the case. The supplies are rather plentiful but trade is slow.

Reports from some of the larger points in U. S. follow:

Chicago.—Trade is diminishing here because there is no relief from the shortage. There are no reserves to speak of being laid up against the Winter months when deliveries will be slow and transportation worse.

New York.—The Jewish holidays that have been taking place in connection with their New Year have interfered with the scrap metal business to some extent. In fact it does not take much letting up in this direction to make a decided difference now. Some dealers have standing orders for all the material they have in their yards.

Pittsburgh.—Yards here are getting pretty well thinned out, and the work of filling them up again is making very poor progress. Dealers are going after and securing grades of scrap that they would not look at in ordinary times. More shell steel is to be made here and there may be relief in the way of increased amounts of shell turnings, etc.

Cleveland.—Dealers here state that the railroad situation is absolutely the worst in weeks. There is a big demand for heavy melting steel. Many delays are encountered in the sorting of material.

Cincinnati.—The profits on the scrap metal business are not large now, according to dealers, who claim that sellers of scrap are insisting on getting the full maximum price, leaving the dealer only the commission allowed by the Government. Dealers say that they cannot do business on this scale and avoid failure.

MANGANESE FOUND IN BRITISH COLUMBIA

Claims Made That Returned Soldier Knew Where Large Deposits of This Were

Discovery of manganese on Vancouver Island is being hailed on the Pacific coast as one of the most notable finds of minerals that Canada has known for some time. Mineralogists who have made inspections of the area in which the discovery has been made have stated that the property near Cowichan Lake is one of the finest prospects yet uncovered.

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AND MANUFACTURING NEWS

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An Engineer Runs Into All Sorts of Jobs

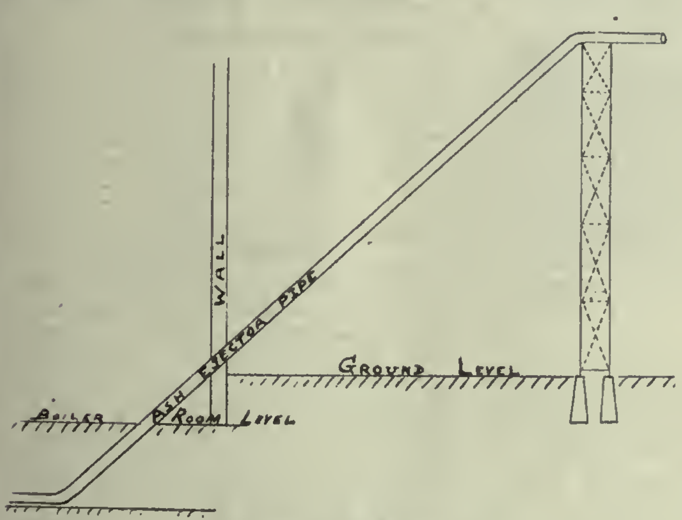
How a Structural Steel Tower Was Lowered Four Feet With Very Little Equipment or Staff to do it With—Essential Thing Had Been Overlooked in the Plans For the Work

By T. H. FENNER, Associate Editor Canadian Machinery

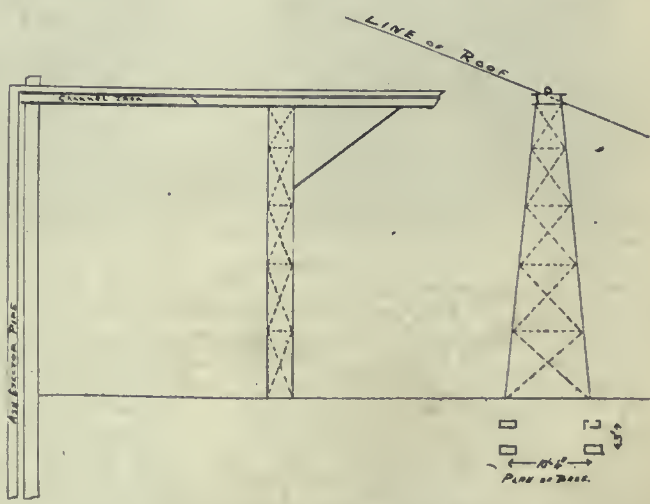
AS an instance of the unexpected propositions a mechanical superintendent is liable to run into, the following will be of interest.

A large industrial corporation was making an installation of coal and ash handing machinery for their power plant, and in connection with the ash ejector it was necessary to have erected a structural steel tower to carry the pipe from the boiler room by means of two channel irons resting on the tower and on the boiler room wall. The location of the tower and beams had been determined by the firm supplying the equipment from blue prints of the power house supplied them by the customer. The arrangement as originally submitted differed materially from that finally adopted, and in making the change one material factor was overlooked by all the parties concerned. The original and final arrangements are shown in the sketches accompanying. The tower was not to be supplied by the concern selling the ash handling equipment, they merely furnishing the design and location to suit their equipment. The factory engineering staff were looking after the erection of all the machinery. Feeling, however, that building structural was perhaps a little out of their line, the job of building and erecting the tower was given out to a constructional steel company. The approximate dimensions of the tower were thirty-five feet high, three feet in width at the bottom in one direction by ten feet wide in another, as shown in the sketch. The main posts were made of 3½ x 3½ x 5-16 angle iron, and the cross bracing of 1½ x 1½ x 3-16 angle iron. The corner posts were bolted at the bottom to four concrete piers, 5 ft. long, by 1 foot square at the top, by 18 inches square at the bottom.

The foundations were placed by the factory staff in accordance with the drawings made by the firm supplying the equipment, and the steel construction people were notified that they could erect the tower and channel irons as soon as they were ready. In due course the gang arrived with the sections of the tower loaded on a large motor truck and men enough to make short work of the erecting. They started in right away to unload the truck and went at the job of coupling the sections of the legs together. The legs were made in two lengths of seventeen feet six inches, making when coupled together the required thirty-five feet. Two sides were laid on the ground with the base close to the foundation. Two or three angle irons were bolted across the posts to hold them together, and they were ready to raise up. Here an object lesson was obtained on the versatility of a well behaved motor truck. The two posts, comprising one side of the tower were raised by the combined efforts of the erecting crew till high enough to enable the truck to back in under them. They were then allowed to rest on the car and the car continued to back, thus raising the posts, when at an angle about forty-five degrees they were blocked up and the guy ropes fastened to the top end. A trestle was then put on the motor truck, catching the posts about half way



ORIGINAL ARRANGEMENT



ARRANGEMENT AS ADOPTED

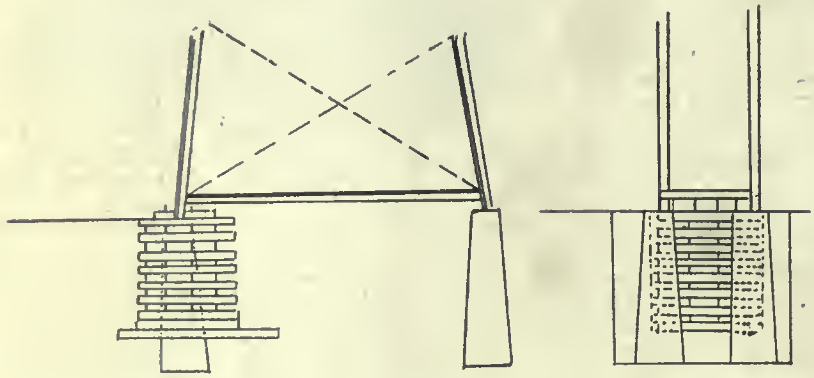
up, and the car again backed up, this time raising the posts almost to the vertical. A good pull on the guy ropes and the two posts stood up in their place, and one side of the tower was erected. Everything was going fine, and in a very short time the other two posts were raised and the men started putting the bracing on.

The Trouble Started

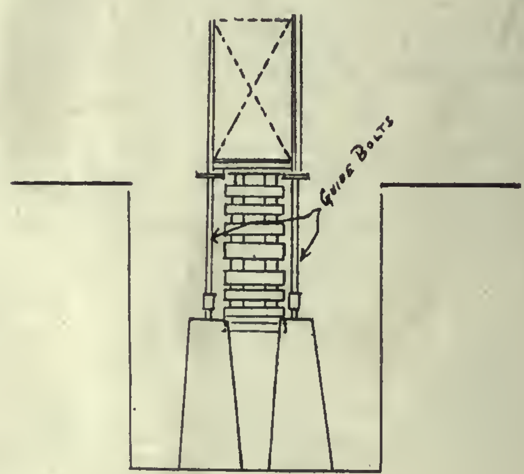
The next operation was to put up the channel iron beams, and here was where the unexpected happened. It was discovered that one of the beams, instead of passing through the wall below the roof, would come out on top of the roof, while the other one would be under the roof, but too close up to it. How had this occurred? A hurried look over the drawing in the light of this new condition disclosed the fact that in altering the plans the angle of the roof had not been taken into account with the result already mentioned. The next question was, what was to be done? The steel men, anxious to get their job done and get away were for cutting the roof. As this roof had been re-slated only the year before at a cost of several thousand dollars, cutting holes in it was not desirable, especially a hole large enough to allow for the beams and the pipe on top of them. The contractors then washed their hands of the job and left, without any further comment. The chief engineer of the plant then decided he would lower the tower bodily just as it stood, lowering the foundations first and then bringing the tower down to them. It would have been easier to take down the tower first if he had the men available, but the staff at his disposal was woefully small and not particularly suited to a job of that kind, and the time necessary to dismantle and re-erect after would have entailed too much expense. The chief thing to guard against in performing the operation of lowering the tower lay in its capsizing on the narrow base, it being fairly stable on the 10 feet direction.

How it Was Done

The method adopted was as follows: Guy ropes were attached to the tower near the top, leading at right angles to the long base to counteract the tipping action on the short side. The ground was dug away from between the foundations to a depth sufficient to allow for the complete amount of lowering required. A crib work of 3 in. planks was then built in this space till it supported the tower on its lower cross-angle irons. The nuts on the holding down bolts of the two side piers were then taken off. The bolts projected through the base of the tower about 3 ins., they having been left long to allow for adjusting, after which they were to be cut off flush. A strong wooden horse, or trestle, which was in use around the mill for general millwright work was brought over to the job and placed close up to the posts of the tower parallel to its narrow axis. Two pair of triplex chain blocks were hung on the trestle and made fast to the base angle close to the post on each side. By heaving up on these blocks the base of the tower was raised to clear the foundation bolts on the two piers, the two on the opposite side being left fast to act as a counterweight. As soon as it was raised high enough to clear the bolts it was blocked up in this position and the chain blocks let go. One was made fast to the chain block and raised out of the pit, making room for a man to get down and dig. The ground was dug out where the pier had been to a depth of four feet and the companion pier was moved from its position and dropped in the hole. This saved lifting it out, and still left room enough for a man to work, making the excavation for the other pier. When this was done the earth was levelled off between the two piers, leaving the floor level at the new depth, and the first pier was dropped down into the place vacated by the second. Two long studs were made, six inches longer than the depth of the new excavation, and these were fitted with a screwed sleeve at one end, which sleeve also screwed onto the top of the holding-down bolt in the pier. The bolt was passed through the hole in the base of the tower and an efficient connection made between the tower and the pier, although they were four feet apart. This served to make one side secure, while the piers were dropped from the other side and the excavations made. (These precautions were necessary as the tower swayed considerably and there was at times a strong wind). When all the piers were in place and the long bolts in position, the tower resting on the blocking, all was ready for the lowering proper. A second trestle was brought up and placed on the other side and two more pair of blocks used. This made it possible to tip the tower on any of the four corners. The first move was to take the weight of one side of the tower on the blocks and remove one course of three inch blocking, then lowering till the tower rested on the next course. Having been level at first the tower was now three inches lower at this side than the other. The strain was kept on the long bolts on this side, and the chain blocks on the opposite side tightened up till the wooden blocking was free. This side was now lowered six inches, making it three inches lower than the side first lowered. This process was repeated alternately on each side till the full four feet had been attained and the tower rested on its foundations again four feet below its original level.



BLOCKING BEFORE MOVING PIERS.



READY FOR LOWERING

METAL RECLAMATION ON THE WESTERN FRONT

In a New York paper recently to hand mention is made of the vast amount of wreckage reclaimed from the battlefields on the Allied front. It states that an average of 7,800 tons of used shell cartridges and about 4,500 tons of various metals are sent monthly to the sorting centres. The work of clearing up is systematically organized, special formations of men being regularly detailed for that purpose. Nothing is overlooked. Everything that can be used is preserved and shipped to a supply depot.

Great minds have purposes; others have wishes.—Washington Irving.

It's not life that matters; it is the courage that you bring to it.—Hugh Walpole.

What Canada is Doing for the Returned Soldier

The Work Being Done in Re-education is Little Appreciated by Those Who do Not Come Into Intimate Contact With it—A Series of Articles, of Which This is the First, Will be Given, Going Into the Detail of the Soldiers' Industrial Re-education

By W. F. SUTHERLAND, Associate Editor Canadian Machinery

LITTLE need be said as to the magnitude of the debt which is owing to those who have been maimed in the service of their country and the whole-hearted spirit with which the government and industries of Canada are co-operating in the reestablishment of the soldier in peaceful pursuits can only be commended in the highest terms.

Every soldier who returns from the front disabled and unable to follow his former vocation is given the opportunity to learn new trades, trades which in the majority of cases are much more remunerative and pleasant that those at which he formerly worked. The majority of us realize at times, perhaps with a bitter sense of regret, that opportunities for education and training in professions closed to us through lack of knowledge do not come with advancing years and the ever-present struggle to make a living wage. The opportunity, then, afforded the disabled soldier to advance his education and to fit himself for better things is in many cases the fulfilment of a lifelong ambition.

Re-education is necessarily closely allied to the restoring of the soldier to complete health and the proper technical training and particular trade learned depend in a large measure upon the disabillties received at the front. While these problems are mutually dependent, vocational training is divided into two distinct branches, occupational therapy and industrial re-education both handled in Canada by the Department of the Soldiers Civil Re-establishment.

Occupational therapy is that part of the training received while the soldier is still under medical care and in some cases has no connection with the training given after the patient is discharged from the hospitals and other institutions as cured. Its main object is to relieve the many weeks sometimes required for convalescence of some of their monotony and tediousness and at the same time to assist in the curing of disabilities by means of movement or exercise necessary to the restoring of injured members to normal use. For instance, to exercise the limb in a case of foot or leg injury and at the same time to divert the patient's mind fret-saw work may be given, or for arm injuries light work of some other kind. But even in occupational therapy the idea now is to give that sort of work which will be preliminary to and dovetail in with real vocational education, which is to begin as soon as the patient is ready to receive further education. If for instance the patient was formerly a sheet metal worker and through injury is debarred from the use of physical strength he is started perhaps as a designer or architectural draftsman in cornice, sheet metal or other architectural design. His practical knowledge is thus built upon and focused in a specialty suited to his capabilities.

"Instead of making futile little baskets or weaving mats that would have no sale except as a camouflage for downright charity, he is furnished with a set of instruments, a bed drawing board and some text books, and given able instruction. The weeks in bed or in wheel chair are utilized practically. When he is able to go into the shops he is well along as a technician and ready for further intensive training."

Scope of Vocational Training

It is well to remember, as before stated, that there are two distinct classifications in this work and the striking difference in the two branches is well noted in the fact that the United States placed them in two totally different departments of the Government. Occupational therapy will be carried out by the Surgeon-General's Department, and industrial re-education by the Federal Board for Vocational Education.

While the above is the case in the United States, Canada has placed the whole problem of industrial re-education and the pension system under the jurisdiction of the department of the Soldiers' Civil Re-establishment, the two branches of this being the Pensions branch and the Invalided Soldiers' Commission, the latter taking over the work formerly done by the Military Hospitals Commission. Occupational therapy is conducted by the department in the hospitals under army doctor direction. When the soldier is discharged as cured the department takes charge entirely and both he and his family, while he is in training, are kept medically and mentally fit. The honorable

VARIOUS WELDING OPERATIONS BY THE OXY-ACETYLENE TORCH IN L'AIR LIQUIDE SOCIETY PORTION OF THE EXHIBIT OF THE DEPARTMENT OF THE SOLDIERS' CIVIL RE-ESTABLISHMENT.

Geo. Foster in a recent statement said that "The Department fathers and mothers the man until he is able to earn his own living."

The soldier, to all intents and purposes a civilian, has his pension suspended while in training but is recompensed by the allotment to him of vocational pay and allowances graduated as follows:

	Per Month
Single men	$50.00
Man and wife—no children	73.00
Man and wife—one child	80.00
Man and wife—two children	85.00
Man and wife—three children	88.00
Man and wife—four children	91.00
Man and wife—five children	93.00
Man and wife—six children	94.00

"Industrial re-education was established as a means of saving disabled men from being a dead loss both to themselves and to the country. It is intended for disabled men who are so handicapped by their disabilities that they cannot return to their former occupations. There is no desire to take all the square pegs in the army and to fit them into round holes for the sheer fun of changing things all around. Round pegs which have been squared by the scars of war are unfortunate in having to be readjusted to holes of another shape, but the Department of Soldiers' Civil Re-establishment has built up an organization which is efficiently doing that work. Be it said to the credit of young Canada that of nearly five thousand men who have been found in need of industrial re-education to enable them to maintain themselves and their families as independent self-supporting citizens, only about three hundred have refused the opportunity offered them. In England and France one of the biggest problems the rehabilitation agencies have to face is that of inducing men to accept the training offered them."

RETURNED SOLDIERS LEARNING LENS GRINDING AND OTHER PRECISION WORK IN THE MAKING OF OPTICAL GOODS FOR THE CONSOLIDATED OPTICAL CO.

Opportunities Available

There is no set number of courses in which industrial re-education is given. Each individual man is trained for the occupation in which he is best qualified to become proficient. If courses were established it is probable that only a limited number would be available, but by the department's policy of placing men in industries after preliminary training in the use of tools or in English or mathematics the whole head field of industry is open for their development and over 200 different occupations have been rendered available.

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Wood Form and Template Makers.
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Wire Splicers.

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Repair Men.

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Moulders.
Ornamental Iron Mechanics.

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Assemblers.
Testers.

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Aluminum Stamping.
Aluminum Spinners.

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Treading.
Finishing.

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Bakers.
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Assemblers.
Wheel Truers.

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Sole Sewers.
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Cutters.
Clickers.
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Cabinet Makers.

CAN MAKERS
Automatic Press Men.

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Spinners.

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Assembling.

CASH REGISTER WORK
Assemblers.
Stock Clerks.

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Rubber Shoe Cutting.
Rubber Shoe Making.

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Saw Tooth Cutters.
Saw Trimmers.

SHEET METAL WORK

Draftsmen.
Sheet Metal Workers.
Erectors.
Press Operators.
Can Makers.
Cutters.

CUPELLATION, A SUBJECT TAKEN UP IN THE ASSAYING COURSE ESTABLISHED AT THE UNIVERSITY OF TORONTO FOR THE RETURNED SOLDIER.

Metal Lithographers.
Tinsmiths.
Stamping.

STABLE FITTINGS

Machinists.
Assembling.

TAILORING

Cutters.
Collar Makers.
Sleeve Makers.
Designers.

TELEGRAPHERS

TANNING

Fleshers.
Vatmen.
Finishers.

UNDERWRITING

Insurance Surveyors.

UPHOLSTERING WORK

Upholsterers.

UNDERTAKERS

WHOLESALE STATIONERY AND BOOKBINDING

Bookbinders.
Cutters.
Rulers.
Leather Workers.
Gilders.
Marblers.
Finishers.

WOOD WORKING MACHINISTS

WIRELESS WORK

Wireless Operators.

WATCH MANUFACTURING
Watch Case Making.

WOOL, PIECE GOODS
Spinners.
Dyers.
Sorters.
Warpers.
Finishers.
Weavers.
Carders.

ELECTRIC WIRE MFG.
Wire Covering and Insulating.

As a contrast to the work being done it is interesting to read of some of the schemes being put forward by well-intentioned but misinformed people and a recent statement by the Federal Board for vocational training for the United States is given:

"Clearing Up A Point"

"There appears to exist in the minds of many people a total misconception of what vocational re-education is, as applied to disabled soldiers and sailors. The Federal Board for Vocational Education, which is charged with the duty of re-educating the injured men, is constantly receiving communications from people who have this, that, or the other supposed art or craft which is offered as being just the thing to teach the poor dear wounded soldiers. These suggestions run all the way from making art-craft out of sealing wax, making paper flowers, and gilding pine cones, to constructing alleged ornaments out of putty.

"The Federal Board does not propose to teach any such rubbish. The education to be given will in the main be in highly specialized occupations which are good paying, recognized, and manly callings which have a definite, useful place in the business world, and a steady demand for such work or the products thereof.

"The difficulty appears to be that many of these well-intentioned advocates of gilded peanut hulls and gimcrack nicknack making are mentally confused, and do not know either what occupational therapeutics and vocational education are, or the part they play. The former is given to divert the patient's mind, to exercise some particular set of muscles or a limb, or perhaps merely to relieve the tedium of convalescence. Occasionally these activities have little or any practical value beyond the immediate purpose they serve, nor are they intended to have any other value."

After the soldier leaves the hospital and is able to undertake training in any desired occupation he is not left to his own devices but under the care of the department is given his vocational pay and receives his instruction free. This instruction is given in the plants of various manufacturers who are devoting space, tools and instructors to the work and who in many cases are able to place the soldier at the expiration of his course of training in their own shops.

If the occupation is such that it can only be learned by the equivalent of a partial university training, this is given by competent instructors at the various universities and technical schools of the country. This instruction may be and often is supplemented by practical work in the shop.

The length of the various courses is approximately six months, although the time taken is fixed only by the soldiers' capabilities and difficulties of the subject undertaken. In every case the work is recognized as distinct from factory production and is directed with a view to education not manufacturing, any benefit to the manufacturer arising from the work being done occuring afterwards, when the soldier if he wishes is engaged on the regular staff.

Re-Educational Work at the Fair

The recent exhibit of the work being done in the re-education of the soldier at the Toronto Exhibition was undertaken that the general public might know something of the results accomplished.

SIR JAMES LOUGHEED, MINISTER OF RECONSTRUCTION, VISITING THE RUSSELL MOTOR CAR SECTION OF THE EXHIBIT OF THE DEPARTMENT OF THE SOLDIERS' CIVIL RE-ESTABLISHMENT.

Occupational therapy was illustrated in the many pieces of fancy work, art weaving, wood carving, hammered brass and bronze articles shown and in the group of men working on the fashioning of similar objects.

L'air Liquide Society is one of the firms which is training returned soldiers and various welding operations were shown in their portion of the exhibit.

The Burroughes Adding Machine Co. had a large display, about a dozen men being at work on various parts of the machines. In this work the men are given a four months' course, three months in the school and a month at actual work. The course includes instruction in operating, construction, and repairing, embracing all the features of the various machines manufactured. The Burroughes Co., at its plant at Windsor, will employ none but returned soldiers, and a movement is on foot to have this rule apply also to the Detroit factory.

In the Russell Motor Car Co.'s corner eight returned men were at work, designing and making tools and parts. An engine lathe, a crank shaping machine, and a universal milling machine were shown in operation. The Russell Co. has a special school for ex-soldiers at 265 Adelaide street west. At present about 20 men are taking the course, which lasts about six months. In this time the firm aims to turn out mechanics as good as those who have had several years' experience in the plant. The eight men who have already graduated are doing very good work.

Several Working on Ores

In the space occupied by the assaying department of Toronto University half a dozen men were busy on scorification work. Galena ore was being put through a muffle furnace, heated to 1,000 degrees Centigrade, to determine its value in silver per ton.

Roden Bros., silversmiths, demonstrated work done at their plant by returned men. This included silver polishing and cut glass work. They give the men a six months' course in their various departments.

The Lanston Monotype Machine Co.'s corner had several men engaged on monotype machines. This company gives a course in keyboard work or casting to returned men, the former being open to only those who were printers before enlisting. The course lasts for about six weeks, and so far more than 20 men have been turned out and have found good positions.

The Multicolor Sales Co. demonstrated work with office presses, which print anything from a business card to a display card nine inches by fourteen. Their course lasts two months.

The Consolidated Optical Co.'s training includes all features of the manufacturing end of the optical business. In their corner of the big display several returned men were shown at work grinding, finishing, making frames and bridges, etc.

How Germany Forged U.S. Passports in the War

Attempting to Give Military Aid to the German Empire—Large Sums Were Spent, But the Fraud Was Soon Detected—How the Scheme Was Shadowed by Secret Service Men

By EARL E. SPERRY and WILLIS M. WEST, for U. S. Commission on Public Information.

THE third chief purpose of Germany's diplomatic officials in the United States was to send troops and munitions to the Central Empires. When the war began in July, 1914, large numbers of German reservists were living in America, and in order to avoid capture on their way home many of them sought under false names to obtain passports as American citizens. They thus violated the law that American passports shall be issued only to citizens of the United States, and also discredited genuine passports, thereby causing delay and distress to American citizens abroad. Their action also was a violation of America's neutrality and endangered its national honor and safety.

In order to have at hand an adequate supply of counterfeit passports, the German Embassy maintained an office in New York City, directed by Captain von Papen, where they were forged by wholesale. German consuls in distant cities, as Chicago and St. Paul, were informed concerning this office and sent there for passports the reservists from their several localities.

These operations were known almost from the first to the United States Secret Service. Hans A. von Wedell, who managed the office, took alarm and fled in November, 1914, supplied with money by von Papen. In the following letter, found on one of his associates, who was arrested before he had an opportunity to post it, von Wedell exonerates himself from the charge of deserting his post and shows the complicity of the German Ambassador in the business of forging passports:

His Excellency, The Imperial German Ambassador,
Count von Bernstorff, Washington, D.C.:
. . . My work was done. At my departure I left the service well organized, and worked out in minute detail, in the hands of my successor, Mr. Karl Ruroede, picked out by myself. . . . Also, Ruroede will testify to you that without my preliminary labors, it would be impossible for him, as well as for Mr. von Papen, to forward officers in any way whatever. (He then explains in detail his reason for hiding.) . . . Ten days before my departure I learned from a telegram sent me by Mr. von Papen . . . that Dr. Starck had fallen into the hands of the British. That gentleman's forged papers were liable to come back and could . . . be traced to me. Mr. von Papen had repeatedly and urgently ordered me to hide myself. Mr. Igel told me that I was taking the matter altogether too lightly, and that I ought, for God's sake, to disappear. . . .
With expressions of the most exquisite consideration, I am your Excellency's
Very respectfully,
(Sgd.) HANS ADAM VON WEDELL.

The connection of von Wedell with the German Embassy in the United States is further shown by the following entry in the checkbook of Captain von Papen:

1914	
Nov. 21—A. von Wedell	$300
" 24—(For Wedell)	240
" 27—(For Wedell)	150
" 30—Wedell	500
Dec. 5—Wedell	500
" 8—Wedell (journey money)	300
" 22—von Wedell	800

Karl Ruroede at once took up von Wedell's work in a different office. He was under the constant surveillance of Secret Service men, one of whom entered his employ and made frequent reports, from one of which an extract follows, concerning conversations with Ruroede:

"You say von Wedell spent $3,500 of his own money?" I asked. "No, no, he got it from the fund." "Well, who puts up this fund?" said Ruroede. "You see, there is a German captain here who is attached to the German Embassy at Washington. He has a list of German reservists in this country, and is in touch with the German consulates throughout the country, and in Peru, Chile, Mexico, etc. He communicates with them, and the consuls send reservists on to New York. On their arrival the Captain tells them . . . 'Go down and see Ruroede.' Sometimes he gives them his card. . . . He draws on this fund for $20 or $300 or $1,000, whatever he needs, and the checks read, 'On account of Reserves.' You see they have to have food and clothing, so there's nothing to show that the money is used for passports. . . . I meet the captain once a week . . . and he gives me whatever money I need. . . . You know there must be no letters, no accounts, nothing in writing."

"If things work out all right now," he said, "we shall be good for three or four hundred passports, and no telling how many more."

When the Norwegian steamer *Bergensfjord* sailed on January 2, 1915, she had on board four German reservists, all of whom were provided with American passports by Ruroede, who had unknowingly obtained them from a United States Secret Service man. As the big liner dropped down the bay she was followed by a United States Revenue Cutter with Federal officers. At quarantine they boarded the steamer, arrested the reservists, and brought them back to New York. Ruroede also was arrested, pleaded guilty at his trial, and was sentenced to three years in the Federal penitentiary at Atlantic. The reservists, guilty of forgery, were punished by fines of $200 each. Charles A. Oberwager was Ruroede's counsel, and under date of January 6, 1915, Captain von Papen's checkbook contained the following entry: "(For Oberwager) $2,000."

German agents in Chicago were making a similar use of American passports. A German reservist reported the following conversation with G. H. Jacobsen, who was implicated in many criminal undertakings in aid of Germany:

Jacobsen told me that an officer who had someone else's citizenship (passport) had shipped for Germany, and when he reached Holland the papers would be delivered to some German agent and sent back, and I could then use them to leave the United States.

Jacobsen obtained citizenship papers for the use of German officers from members of the German Club; and when the description did not fit the person who was to use it, a German printer in Chicago made the description fit by changing it.

There are many cases, from which the following are a selection, in which American passports were fraudulently procured and used for unneutral purposes. Captain Boy-Ed, Richard P. Stegler, a German citizen, Richard Madden, and Vincent Cook secured through conspiracy an American passport to be used by Stegler while serving as a spy in Europe. Boy-Ed financed and directed Stegler's operations, but was protected from prosecution by his diplomatic immunity. Madden and Cook were sentenced to ten months and Stegler to sixty days in jail.

Ilbert Sanders and Charles Wunnenberg, German agents in this country, have pleaded guilty in New York to the charge of sending German spies to England equipped with American passports which was used by Stephen Geisner, an attaché of the Austrian-Hungarian Consulate at New York City, to return to Austria.

The diplomatic officials of Germany hired American citizens protected by genuine passports to use them for dishonorable and unneutral purposes, such as to carry German dispatches and to act as spies in England. E. G. Woodford, for example, who was sent to Europe by German officials here was paid $550 for his services on orders from Berlin. The payments to him are recorded in the cashbook of Wolf von Igel.

Fraudulent Manifests

German agents in the United States also endeavored to give military aid to their country by sending coal and other supplies to German warships which were raiding commerce in both the Atlantic and Pacific oceans. Such action was a violation of American neutrality, and in order to evade the law the conspirators took false oaths before Federal officials concerning the ownership of vessels, the nature of their cargoes, and their destination. These acts, even more than the use of forged passports, were likely to cause friction between the United States and countries with which it was at peace.

The Hamburg-American Line, through its high officials in New York, repeatedly defrauded the United States by procuring false manifests. Among those involved were Dr. Buenz, managing director, George Koetter, superintending engineer, Adolph Hachmeister, purchasing agent, and Joseph Pappinghaus, who together worked up an elaborate machinery to deceive the Government. They confessed at their trial that they had sent out twelve ships, which were proved by the Government to have fraudulent papers and all of which were captured and interned before reaching their destination. Nine of these vessels were chartered, and the Hamburg-American Line paid to the owners for their losses about $1,400,000. The following copy of Captain Boy-Ed's account at a New York bank indicates that he had large sums at his disposal for conducting Germany's naval operations from the United States, and that he reimbursed the Hamburg-American Line for this and other expenditures:

1914	
July 24—Received from National Bank of Commerce	$ 250,000.00
" 26—Received from A. Vogel	70,000.00
Aug. 1—Received from National City Bank	100,000.00
" 1—Received from Speyer & Co.	100,000.00
" 2—Received from National City Bank	200,000.00
" 3—Received from Speyer & Co.	500,000.00
" 5—Received from Bayer Co., Inc.	300,000.00
" 16—Received from Kuhn, Loeb & Co.	35,000.00
" 24—Interest	1,941.11
Oct. 26—Received from National City Bank	300,000.00
" 27—Received from Kuhn, Loeb & Co.	150,000.00
" 29—Received from Kuhn, Loeb & Co.	1,200 000.00
Dec. 1—Interest	5,253.00
	$3,262,197.11
Oct. 24—Paid to Hamburg-American Line	$1,200,000.00
Dec. 2—Paid to Hamburg-American Line	1,961,365.36

Gustav B. Kulenkampf of New York, who was employed by the Hamburg-American Line to draw up the false manifests, stated at the trial that he received $750,000, which was subject to the order of Captain Boy-Ed, naval attaché of the German Embassy, and was largely spent on the Pacific Coast. His evidence proved that, like the forgery of passports, fraud and perjury were committed under the direction of German officials protected by the diplomatic privileges which all civilzed nations consider sacred. Buenz, Koetter, and Hachmeister were found guilty of conspiracy to defraud the United States, and were sentenced in December, 1915, to eighteen months in the Federal penitentiary at Atlanta. Pappinghaus was sentenced to a year and a day.

Similar means were employed by German agents on the western coast under the direction of Captain Boy-Ed to send provisions and coal to German raiders in the Pacific. The steamers *Sacramento and Mazatlan* were there engaged in this illicit traffic. When the *Sacramento* once cleared with a large cargo for Valparaiso, Chile, but reached there empty, the captain explained that on the way down she had been commandeered by the German fleet and her cargo removed. Besides the Hamburg-American officials already mentioned, more than 15 individuals and firms have been convicted in the United States courts of fraud or perjury in their efforts to assist Germany by illegal means.

Perjury was also employed in a notable instance to justify Germany's conduct. When the passenger liner *Lusitania* was sunk by a submarine on May 7, 1915, with its great load of non-combatants, the German Government and its ambassador in America asserted tht she was in law and fact ship of war because laden with ammunition and armed with four cannon. In order to prove this statement, Ambassador von Bernstorff sent to the Department ot State four affidavits swearing that the *Lusitania* was armed. Three of these were worthless as testimony, and the fourth had been procured by Paul Koenig, of the Hamburg-American Line, from Gustav Stahl, a German reservist. Federal officials knew that the *Lusitania* was not armed and that Stahl must have sworn falsely. He was accordingly tried for perjury, confessed his guilt, and was sentenced to eighteen months in the Federal penitentiary at Atlanta.

Violations of Parole

When the British fleet was clearing the seas of enemy warships, two German cruisers, *Printz Eitel Friedrich* and *Kronprinz Wilhelm* sought refuge in the harbor of Norfolk, where they were interned. The German officers pledged their word of honor to our Government, which had opened the harbor for their protection, that they would not escape from the jurisdiction of the United States, and accordingly were allowed every liberty.

Several officers of the *Kronprinz Wilhelm* purchased a yacht after some weeks had passed, on the pretense that it was for pleasure cruises. They secretly stocked it with supplies and one night sailed away. They were given the necessary funds for their escape by the German Consul at Richmond, and Captain Boy-Ed filed a message at Sayville, asking the German authorities in Berlin for instructions for these officers. Paroled German officers at San Francisco and Guam also violated their oaths to remain within the jurisdiction of the United States.

The Military Information Bureau

The collection of data concerning the production of war materials in the United States and its transmission to Germany were among the many duties of Ambassador von Bernstorff and his attachés. A Military Information Bureau under the direction of Captain von Papen was maintained for this purpose at 60 Wall Street, New York City. The following memorandum found among the papers seized there by the Federal authorities gives some insight into the methods of von Papen:

(Strictly Confidential)

New York, December 16, 1915.

Memorandum.—This refers to my call at your residence on Monday last, during which you requested me that I should make every effort to get particulars regarding a certain rifle, said to be manufactured by the Westinghouse Company.

In connection herewith I have now made certain connections which may result in being able to accomplish the above. I have been given to understand that I may even procure a sample, if it can be had.

As this matter may necessitate an expenditure of from $100 to $200, would ask you to consider whether it would be advisable to lay out such an amount for information of this kind, including a sample rifle; should the latter not be absolutely necessary, probably I can secure a description of the rifle at a very limited expense.

Would appreciate if you would let me know what is desired.

Yours faithfully,

XXX.

"XXX" was the symbol used in confidential correspondence with the German Embassy and its attachés to designate Paul Koenig, director of spies, who, among many other duties, collected information about the manufacture and transportation of munitions. His most valuable source of knowledge was a clerk in the National City Bank of New York, Frederick Schleindl, through whose hands passed not only telegrams from the Allied states transmitting money for the purchase of war materials, but also orders for them and letters of advice from the manufacturers, which frequently named the railway by which the munitions were transported and the vessels to which they were consigned. For men who were endeavoring to burn or blow up munition ships, such information was invaluable.

Schleindl went at least once a week to Koenig's office in the Hamburg-American building with letters from various military attachés, agents, and brokers of the Allies. These and other stolen documents were copied and then restored to the files of the bank on the following morning. Schleindl received from Koenig $25 a week for this service.

That Hans Tauscher also assisted von Papen in the work of gathering military information, is shown by a bill of $157.65 sent to him by B. Glaser, of New York City, for "investigating and obtaining cartridges from December 4 to December 10." This investigation was made at Bridgeport, Connecticut, and to obtain the desired information and the samples of cartridges, money was paid to girls and forewomen employed in the factories. Captain von Papen's checkbook shows the following record: "Dec. 18, H. Tauscher (for Glaser, Bridgeport), $157.65."

One Theodore Otto also made frequent statistical reports to the German embassy on the manufacture of munitions and arms at various American factories.

A notice in a German technical paper for May 8th states that the important Bavarian establishments for the production of nitric acid from the air are to undergo considerable extension, in which some 200,000 horse-power of water-power will be used. A strong syndicate of bankers and others has been formed to carry out the scheme, which will involve a capital of 150 million marks.

* * *

THE ELECTRIC furnace has made possible what may be regarded as almost a revolution in the steel industry. It is the conversion of scrap steel or iron back into pig iron. What may be called "synthetic pig iron" is now a commercial product; in other words, the original constituents of pig iron are being made to reunite in the condition originally assumed. This unusual achievement is another evidence of the adaptability of electrical energy to the production of results impossible by any other means. The new process is being applied commercially in a large electric steel plant in the eastern part of the United States, high-grade or- low-phosphorus pig iron being made directly from ordinary scrap steel. Not only is pig iron being produced in large quantities, but "wash" metal and iron and steel castings are made in the same furnaces. The pig iron sells in the open market as a competitor with regular low-phosphorus blast-furnace iron, the wash-metal goes to crucible steel makers, and the iron castings are sold to local users, or else are used by the company in its rolling mill. The idea is not new, but this is the first record of its commercial exploitation in the United States.

Safety Code for the Operation of Electric Cranes

Association of Iron and Steel Electrical Engineers Formulates Complete Set of Rules For Operators—Adoption of Rules Will Lead to Fewer Accidents and Less Loss

A COMPLETE set of rules for the safe operation of electric cranes which may be the means of avoiding heavy losses through damage claims and which were prepared after an exhaustive study of the situation with respect to the rights of employers and employees and the law was presented to the Association of Iron and Steel Electrical Engineers by its safety committee at the association's twelfth annual convention in Baltimore, Sept. 11-14.

The committee in its report emphasized the necessity of the employer placing in the hands of his employees printed rules that should be complied with for prevention of accidents, stating that only by so doing may the employer remove the possibility of an injured workman obtaining excessive damages on the grounds that he had not been properly warned. Verbal instruction may be denied and a doubt created which would be favorable to the contestant. The law implies and in some cases demands that hazards of every situation employees are brought in contact with shall be made known to them before they begin work; also that they be instructed how to do their work so that no injury befall themselves or fellow workmen.

The committee declares that the rules should be understood by employers as well as employees and that they should be carried out even at the cost of delays. The rules provide for their own enforcement, each rule being followed by explanatory paragraphs stating the authority and duty of the employee. The rules follow:

1. While the operators of cranes usually are subject to orders of operating foremen, in the departments where they are employed, they should not start a motor even when ordered to do so, if so doing is likely to cause an accident.

(a) A signal to stop the travel of a crane or the movement of any of its parts, by whoever given, should be obeyed.

(b) A motor should not be started, to make a lift, if the operator knows that an improper hitch has been made with chains or slings, or if hooks permanently attached to the crane fixtures are not properly adjusted.

(c) In any case of doubt as to making a lift with safety the crane operator should call the attention of the foreman in charge to the condition that created the doubt.

2. The crane operator should be held responsible for the safe condition of his crane insomuch as he should know by observation from his cab and from inspections of the entire crane.

(a) He should see that all bearings are properly oiled; that all cables are traveling properly on their drums; that brakes, limited devices, controllers, switches, hooks, yokes, blocks and other attachments are in good and proper condition.

3. Operation of cranes while doing construction or repair work should be governed by a code of signals prescribed by the management. They should be given by some one person known by the operator to have authority. On occasions when it obviously is necessary to deviate from this rule the operator should act with exceeding caution.

(a) Cranes engaged in their regular routine work should follow such practices as is the custom in the mills they are operated in and as has been agreed on by the operating management.

(b) Changing rolls, removing and replacing parts of machinery, working two cranes to lift one load, and all unusual operations are classified with repair work and operators should be governed by signals when cranes are so employed.

4. When more than one crane is operating on a runway, an audible signal should be sounded, to avoid collisions when moving. Signals should be sounded when cranes are moving while carrying suspended loads in the vicinity of where men are working.

5. Cranes carrying material should be so manipulated as to avoid carrying suspended loads, or magnets with or without loads, over men working below. In cases where men working below cannot or do not from any cause whatever move away the crane should stop if the line of travel of the load or magnet is over the workmen.

6. Operators on leaving their crane cabs to inspect, oil or repair parts, or to get off the crane, should open the main switch and lock it open with a safety seal lock.

(a) Switches controlling the current to magnets should be kept constantly open and locked open while the magnets are detached, or while they are not in use.

(b) On notification from workmen that they want to disconnect the magnet, the operator should open the main switch and lock it open, before the wires are disconnected.

7. When handling ladles filled with molten metal, the brakes for controlling ladle hoists should be tried to see if they are in good working order before the ladle is moved from over its support. To make this trial the ladle should be lifted a slight distance, then apply the brake to see if it will hold the load.

(a) Ladle cranes with but single motors and outfits for the ladle hoists should not be used to handle a ladle containing metal when the brakes will not hold.

8. Operators should not leave the crane cab for any purpose whatever while a heat of metal is suspended from the crane. In case any adjustment of parts of the crane is required help should be called on to make it.

9. Operators should be responsible for preventing men from riding on their cranes who are not required to do so for some purpose. They also should be responsible for preventing men from riding on any attachment to the cranes as hooks, magnets, etc.

(a) At all times, whether carrying loads or not, hooks and chains should be kept high enough to clear men or apparatus below the crane.

(b) Blocks should not be lowered below a point where less than one and one-half turns of cable will remain on the drum.

10. It is not good practice to make side pulls. If they are permitted they never should be made by use of ladle hoist.

11. Prompt action is required to stop the descent of a load when the brake will not hold. If it should be necessary to apply power to a motor in order to stop the travel of a crane or the descent of a load the contact point of the controller lever should be moved for lifting or reversing as the case may require, one point only beyond the off position. If this does not give enough power then try the second point, continuing the movement one point at a time as necessity requires, but no more power should be applied than is actually required to bring the crane or load to a stop.

12. Two or more safety seal locks for locking switches open should be carried in crane cabs along with the tool equipment. These locks should not be used for any other purpose than to keep a circuit open when the closing of it might cause an accident.

(a) The crane operator should use a safety lock for locking the main switch open every time he leaves the cab to go on the crane runway, or out on the crane for inspection or to make adjustment of parts.

(b) The inspector should, in addition to notifying the crane operator of his intentions, use a safety lock for locking the main switch open, every time he goes out on the crane.

(c) Repairmen should in addition to notifying the crane operator of their intentions, use a safety lock for locking the main switch open every time they go on the crane. The foreman in charge of repairs should be responsible for locking open the main switch and all individual switches, while repairs are going on and for removing the locks when the repairs are finished and the men are off the crane.

NATIONAL IMPORTANCE OF ENGINEERING INDUSTRIES

During the past four years we have learnt more than in the previous four decades concerning the national importance of certain industries. When we say "we" we mean our legislative representatives, public men, and government officials, and possibly hundreds of thousands of toilers who earned their daily bread in industries of whose larger aspects or bearing they knew but little. Engineers as a body cannot be included in that "we," for large numbers of them, profiting from the nature of their calling, and from the stimulus that the greatness of engineering work imparts to the imagination, have known something of the value of their achievements to civilization and the general development throughout the world. It is satisfactory that, under the influence of the terrible events of the war, the necessity for deciding what is and what is not essential for the successful conduct of military and naval operations has brought both us and our industries under close examination. Engineering and engineering workers have emerged from the experience with such a testimony concerning their usefulness to the human race as should not only gratify them for the present, but should auger well for very many years to come. Nobody can read the reports that have been published during the last few weeks regarding the engineering, iron and steel, and electrical industries, and the measures that should be taken for safeguarding them against international competition after the war, without being impressed with the great importance of these industries to the nation and to the British Empire as a whole. It is not necessary to be an engineer, or even remotely connected with the industries, in order to appreciate how much they mean to millions of our population; therefore it is not unreasonable to hope that in the legislative and in political life, which have not in the past counted engineers among them in any fair proportion, there will be a desire to adopt as many as possible of the recommendations now advanced. The report of the Electrical Trades Committee occupies its opening pages with a fairly full statement on the national importance of the electrical industry, which, it says, has never been realized either by government or by the general public, with the consequence that both the industry and the country have suffered from legislative errors. It is even said that the loss sustained by the nation through failure to take full advantage of electrical progress is estimated by "witnesses of high authority" at not less than £100,000,000 a year, and it is added that that loss is preventable by concentrating generation under improved administration. The war is stated by the committee to have demonstrated the safety of the Empire to be dependent on the employment of electricity. What is meant by this is that the output of munitions in the great industrial areas could not possibly have attained anything like its present scale had not an enormous aggregate horsepower of electrical energy been available for the supply of power and light. "The emergency has proved the electrical industry to be a 'key' industry."

THE ELASTIC LIMIT

We have long held the view that only under special conditions and kinds of stress does the elastic limit form a proper basis for the proportioning of machine parts or the elements of structures. To this general rule the main exception is provided by the case of alternating stresses. Here the trend of experience gives support to the view that safety is to be sought by keeping the range of stress within the elastic range of the material. In some other cases it is also advisable to use the elastic limit as the basis for proportioning dimensions, since even though an excessive stress might not actually endanger the safety of the structure, the risk of a permanent set may be highly undesirable.

As instancing how little the safety of structures, strained in one direction only is dependent on the elastic limit, the bombs used by Professor Bridgman in his experiments on the behaviour of materials under extremely high pressures may be referred to. The process of producing them is described by Dr. J. Johnston in a paper published in the "Journal of the Franklin Institute." A block of steel, after appropriate heat treatment, is bored with a hole 1 mm. less in diameter than the intended final dimension. This is then filled with kerosene oil and subjected to a pressure of 20,000 atmospheres or more. This causes a bellying out of the hole, which is then reamed to its final diameter. Under this treatment the metal is so strengthened and stiffened that the bomb is capable of carrying repeated applications of pressures of 10,000 atmospheres or more. The leak-proof piston used with these bombs consists of a hardened steel plug finished a nice fit to the hole. This piston is packed by a series of washers, successively of rubber, copper, and of soft steel, which are followed by a hardened steel collar which takes the thrust of the ram by which the pressure is applied.

The methods followed by Professor Bridgman have, we think, a bearing upon turbine engineering. With the rapid increase in size and speeds the stresses on the wheels at the exhaust end of the turbine have risen greatly, and further progress may be checked if designers persist in estimating their factors of safety on the basis of the elastic limit. The stresses to which such wheels are subjected are nearly as steady as hydraulic pressures, and actual experience has shown that no permanent injury results even if the metal be strained considerably beyond its elastic limit. For example, at the Birmingham meeting of the British Association in 1913, Mr. Gerald Stoney recalled an instance in which a wheel intended to be run at 5,000 r.p.m. was by error tested at a speed of 8,000 r.p.m. The consequence was the bore stretched ¼ inch. No permanent injury resulted, however. The wheel was rebored and passed into service, where it proved quite satisfactory. An overstrained material requires some little time to recover itself, but as this was allowed in the above instance the wheel was probably stronger than before.—Engineering.

A COMEDY OF ERRORS

The Fire Marshal of the state of Wisconsin has issued a bulletin which he terms a "Comedy of Errors." It should have been called a tragedy. It says:

He looked for a gas leak with a match, and found it.

He lighted a match to see if his gasolene tank was empty. It was not.

He smoked while filling his auto tank, but will do so no more.

He smoked in bed; so did the bed clothes.

He threw the matches into the waste paper basket. He is wiser now.

He threw a cigarette stub into some rubbish.

He saved his oily waste and oily rags and they burned the shop.

He washed his hands in gasolene near the stove. The doctor washes them now.

He did not worry about fires as he had "plenty of insurance," and forgot the safety of his wife and children upstairs.

He stuffed up the chimney holes with paper and rags.

She cleaned her gloves with gasolene and saved fifteen cents, but paid the doctor and druggist fifteen dollars.

She poured kerosene into the lamp while the wick was burning.

She put gasolene into the wash boiler on the stove to make washing easier.

She dried clothes too near the stove.

She used the wrong oil can.

She burned sulphur all over the house to fumigate.

She used the wood-box back of the range as a waste paper receptacle.

She gave matches to her children to go out to burn leaves in the yard. The cotton dresses burned easier than the leaves.

She was "coming right back," so left the electric current on in her iron.

She swung the gas bracket too close to the curtains.

She fixed up a fine tissue paper shade for the lamp.

She filled the tank of her gasolene stove while one burner was going.

The comedies have turned to tragedies; many of the scenes of action were in ashes and too many of the actors are maimed or dead, more will follow, no doubt, as they are prone to ignore the advice and experience of others instead of profiting by their errors and sufferings.

It is not enough to be industrious; so are the ants. What are you industrious about?—Thoreau.

Laws Governing the Fluidity of Molten Cast Iron

Fluidity Depends on Several Factors Which Affect the Melting Point—The Author, in a Paper Read Before the British Foundrymen's Association, Explains Some of the Vagaries in the Operation of the Cupola

By MATTHEW RIDELL

THE many varied and widely divergent views which are held by experienced foundrymen concerning the correct construction and the proper manipulation of the cupola are too well known to need recounting. The mere fact that after so many years of experience and discussion there should be still such diversity of opinion on this topic is noteworthy. It would seem to indicate that either the cupola, or its process, is not the simple matter it appears to be, and that some more scientific explanation than common sense is required for the solution of the problem.

The fluidity of cast iron depends on the amount of superheat or number of degrees of temperature over and above its freezing temperature that has been imparted to it in the cupola. The greater the superheat the greater will be the fluidity or degrees of life possessed by the metal, and, other things being equal, the longer will it remain fluid to fill up the intricacies of the mold.

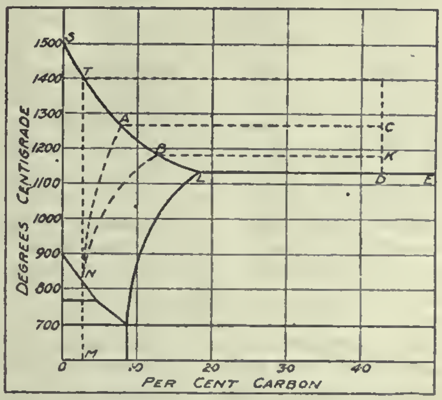
Dull Iron

When the metal runs dull from the cupola and is sluggish, its degrees of temperature or life are not far removed from the solidifying temperature. It is deficient in superheat. The reasons which one may hear ascribed in the foundry for the poor working of the cupola are many and various. Some blame the air supply as too great or too strong; others would have the quantity or pressure reduced; but the majority, recognizing that the coke plays a most important part in the production of heat, and knowing that the manager is prompted by considerations of economy in the use of this material, are inclined to conclude that economy has been carried too far. To these the sure remedy is more coke. It seems but natural to suppose that an increase of coke ought to result in a larger amount of heat being developed in the cupola. No doubt it does so result, but repeated experience shows that after a certain limit of coke in the charge has been reached further additions appear to make the metal more dull instead of more fluid. This and some other peculiarities of the cupola which seem to defy common sense explanations have for a long time puzzled the writer, and the solution herein advanced occurred to him while investigating the problem in connection with semisteel difficulties.

Among the peculiarities which the present argument appears to solve satisfactorily may be mentioned the following: Better results are obtained in securing hot metal when the bed coke is not well lighted above the tuyeres, before the blast is put on and the first iron takes longer to come down, than are secured when the opposite conditions prevail. Many foundrymen have noted this peculiarity, but explanations have not been satisfying. Also, it has been noted that foundry irons with high silicon are generally fluid, while those with high sulphur are inclined to be sluggish when melted under similar cupola conditions. It appears generally to be taken for granted that the actual temperature at the spout of these different classes of irons is the same, or approximately so, in all cases, and that the fluidity or sluggishness of the metal is due to some inherent quality of the respective elements—silicon and sulphur.

Not Satisfactory for Superheat

An examination of the cupola and of its load will show that as an instrument for imparting superheat to a molten metal it is as unsatisfactory an arrangement as could have been devised. It is divided into three zones, as follows: (1) The bed into which the metal flows as soon as it is melted; (2) the melting zone where the maximum heat is developed and the solid metal converted to the fluid state; and (3) the stack wherein the descending charge is being heated by the ascending gases.



EQUILIBRIUM DIAGRAM

From the foregoing it will be noted that the point at which the temperature is high enough to melt the solid iron is well removed from and over the basin or well into which it flows when melted. After the door of the cupola has been made up there is no combustion going on in the bed coke below the tuyeres and, therefore, no heat is being generated in that quarter. So soon as the metal reaches its melting temperature and becomes fluid in the melting zone it passes rapidly away from this high-temperature zone into the basin at the bottom of the bed. In some cases it passes out of the cupola altogether, and consequently cannot come under the influence of subsequent heat. What little superheat the metal may have acquired at the region of maximum temperature is largely discounted in its journey to the bottom of the cupola. Besides having to pass the tuyeres, which are discharging large quantities of cold air into the furnace, it will have to part with some of its heat to the coke which makes up the bed. If there was nothing more involved in the melting of metal in the cupola than the question of heat it would be extremely difficult to account for one kind of iron coming out more fluid, and therefore hotter, than an iron of a different class. Under similar conditions of melting all metals should have imparted to them the same degrees of heat.

It is a common belief that all substances which pass from the solid to the liquid state and vice versa make these reverse changes at the same temperatures. For instance, ice becomes water when the temperature begins to exceed 0 degrees Cent. and water changes back into ice as the temperature begins to be less than 0 degrees Cent. Every substance has its own melting and freezing points which are supposed to be identical for each substance. This assertion is true of all simple bodies or of alloys which retain their components in solid solution. It is because pig or cast iron is an exception to the rule that the cupola is practicable at all as a melting instrument. If any of the materials which adhere to the rule were melted in the cupola they would probably resolidify in the bed, or at the best would come out of the cupola so dull as to be useless for casting purposes owing to the lack of superheat or life.

To investigate the behavior of cast iron in the cupola and to ascertain, if possible, why it should be an exception to the general rule, it will be necessary to refer to the accompanying equilibrium diagram and the information it gives concerning the iron-carbon series of alloys.

The main fact to be noted is that both the melting and freezing temperatures depend on the amount of carbon in the alloy, that is, the amount of carbon in solution in the iron at the time. The lower the amount of carbon which is in solution the higher is the temperature at which the changes of state take place, The lowest freezing or melting temperature is at about 1130 degrees Cent., but it is only such an alloy as has about 4.3 per cent. carbon to 95.7 per cent. iron that will freeze or melt at that temperature. An increase in the amount of either of the elements in solution results in an increase of the temperature at which the changes take place, 4.3 per cent. is the saturation point of carbon in iron when these two elements are reckoned alone. With ordinary pig irons this figure obviously requires adjustment on account of the presence, in greater or lesser quantities, of other elements. For the purpose of the present argument it may be taken for granted that foundry irons contain very near the saturation amount of total carbon. If all the carbon of a 4.3 per cent. total carbon or saturated cast iron were in solution or combined with the iron, the metal should melt or freeze at about the temperature of 1130 degrees Cent. Fortunately for the reputation of the cupola the carbon in pig iron is found separated out as graphite as well as being in solution or combined in the iron.

Melting Temperature

As the melting temperature is determined by the amount of carbon in solution only in the iron at the time it reaches the melting zone, the free graphite is left out of account. It follows, therefore, that an iron which is very low in combined carbon, although high in total carbon, cannot be melted until a very high temperature is reached. The mass or body of metal will remain in the solid condition until the high temperature is attained, and consequently the liquid metal will be extremely hot. In the course of melting the free graphite is rapidly dissolved and enters into solution with the iron, with the result that the molten mass has a high percentage of combined carbon and therefore a low freezing point. Under such conditions an iron which will not melt until it has been heated to, say, 1400 degrees Cent., does not freeze again until the temperature has fallen to about 1130 degrees. Such a metal may be said to have 270 degrees of life and will appear fluid.

If, on the other hand, the combined carbon in the pig iron is already high, the temperature at which melting begins will be low, and even after the free graphite is dissolved will possess only a few degrees of life or superheat.

Another point which the writer would like to emphasize is that it is the amount of carbon in solution at the time the metal enters the melting zone and not necessarily that of the original iron charged into the cupola that determines the temperature which will be attained in the process of melting. It has to be borne in mind that after iron has reached a certain temperature much below its melting poin andt has been converted into gamma iron it dissolves carbon very readily. This implies that if in the course of heating, graphite is being reduced while the percentage of the combined carbon is increasing in the iron, the melting point will be lower than indicated by the original analysis. It is obvious that in order to obtain the hottest melted metal it is essential to get the unmelted iron into the melting zone as quickly as possible. The absorption of the graphite is not instantaneous, but the rate at which it takes place increases as the temperature rises. When, therefore the descent down the stack is slow and the metal is held above the melting zone through excessive coke in the charges, the iron is afforded an opportunity to dissolve the graphite, with the result that the material enters the zone with a lower melting temperature than it otherwise would have had. One can see from this an explanation of why excess coke results in duller instead of more fluid iron. The same explanation applies to the bed coke. If this is too high, or if the bed is so burned up that the metal is brought to a red heat, in many instances little short of actual melting, before the blast is turned on, the amount of graphite that has entered into solution will be considerable, and the pig will melt at a comparatively low temperature. So long as the first charge is resting on coke which is not yet alight when the blast is turned on, its combined carbon is unchanged, and the quick combustion of the coke by the blast raises the maximum temperature in the cupola before the absorption of graphite has been able to proceed along very far.

The theory likewise explains the reason of the differences in the fluidity of siliceous irons, as it is only necessary to take into account the accepted actions of silicon and sulphur with regard to the solubility of carbon in iron. Silicon by reducing the solubility makes it more difficult for the graphite to become absorbed while the temperature is being raised, while the influence excited by sulphur is all in favor of combined carbon.

Source of Superheat

In a previous paper on the subject of semi-steel, the writer, arguing from the equilibrium diagram, advocated the use of high carbon steel, such as files, etc., because of the greater ease and lower temperatures at which such material could be melted. Experience has proved that the results to be obtained from mild or low carbon steel are superior to those which the use of files will afford. Does not the theory here offered suggest an explanation in that the question of superheat and its source was overlooked? The high carbon steel with all the carbon in the combined form would have a lower melting temperature than the pig iron itself, and its influence would be to impart a dullness to the molten mass, and so render its homogeneity more uncertain. In the case of phosphoric irons. in which the fluidity is such a marked feature, it is necessary to look to the diluting effect of the phosphide eutectic. The phosphide eutetic becomes fluid at about 950 degrees Cent., and so long as it remains entrapped in the otherwise solid metal it is acquiring superheat and increasing its fluidity accordingly. As this phosphide eutectic may constitute 15 per cent., or even more of the mass under treatment, the diluting effect of such a considerable volume of highly fluid material is manifest.

Conclusions Reached

The foregoing statements may be summarized briefly as follows:

The fluidity of cast iron depends on the degrees of heat which it has attained in excess of the freezing temperature.

The cupola is not suited to impart directly superheat or fluidity to any material which is being melted therein.

While the freezing temperature of foundry irons for all practice purposes, may be taken as constant, at about 1130 degrees Cent., the melting temperature varies, and is regulated by the amount of carbon in combination or solution when the material enters the melting zone.

In view of the gradual absorption of carbon into the iron as the temperature rises the practical conclusion suggests itself that in order to obtain the molten metal in the most fluid condition the solid material in the cupola should be introduced into the melting zone as quickly as possible.

Excess of coke in the charges, too much coke in the bed or too fierce burning of the bed before blast is turned on must result in dulling the iron.

Equilibrium Diagram

On the accompanying diagram an attempt is made to illustrate graphically the principal features of the foregoing remarks. SLDE is the solidus curve of the equilibrium diagram. Any alloy of iron and carbon whose ordinates of concentration and temperature intersect below the curve can normally exist in a completely solid state. Before the alloy can become in any way liquid the ordinates must intersect above the solidus curve. Above SDE the alloy is completely liquid and begins to solidify, when the ordinates of concentration and temperatures intersect on the curve.

The dotted curves represent the melting and freezing processes of an iron with 0.3 per cent. combined carbon, 4 per cent. graphite carbon, the balance of 95.7 per cent. being assumed to consist of iron only.

If the temperature of the solid metal is raised without change taking place in the carbon arrangement it will attain to 1400 degrees Cent. before the metal will begin to melt, as indicated by the dotted line MNT. The curves MNA and MNB show the difference brought about in the temperature at which the metal begins to melt. through free carbon being absorbed in solid solution in the iron while the mass is accumulating heat. After the temperatures TAB have been acquired, and as the metal melts the remaining free carbon is rapidly dissolved as indicated by TF, AC and BK. The liquid solutions each containing 4.3 carbon in combination have temperatures F, C, and K, respectively, but all begin to freeze at the same temperature D (1130 degrees Cent.) The superheat or fluidity of the first is FD, which is greater than that of the second, CD, and still greater than that of the third, KD.

Importance of Diagram

Dr. W. H. Hatfield complimented the author on the development of the equilibrium diagram, adding that he entirely confirmed what Mr. Riddell had said concerning its importance. From the metallurgical standpoint it was impossible to understand the properties of cast iron until the diagram had been properly studied. Prior to writing his book on Cast Iron Dr. Hatfield spent three years in following through the evolution of the diagram. However, he was unable entirely to follow Mr. Riddell in his deductions. The diagram was constructed on cooling curves of alloys containing from nothing to 5 per cent. of carbon. Mr. Riddell had been deducing his conclusions from the properties of low carbon alloys, namely, steel containing 0.2 to 0.9 per cent. of carbon. The term equilibrium must first be understood, added Dr. Hatfield. It means that if an alloy is maintained for a sufficiently long period at a certain temperature certain phases or conditions will be realized. The D point on the diagrams is the eutectic and if 4.3 per cent. of carbon is in a carbon alloy, freezing would take place at about 1130 degrees; but in ordinary cast iron containing from 1 to 3 per cent. of silicon, the freezing point of the iron is modified. The first results of added silicon is to reduce the solubility of carbon. If an iron containing 3 per cent. of silicon with, say 3.2 per cent. of carbon was gradually raised in temperature it would be found that the carbon absorbed would be in conformity with the diagram. Dr. Hatfield could not agree with the theory that with the cupola it is possible to heat a piece of cast iron to a temperature so high as had been indicated without fusion taking place. He suggested that Mr. Riddell reconsider his theory in the light of the suggestions offered and he thought he would find that equilibrium would be attained much more readily than was stated in the paper. In actual foundry operations ordinary foundry iron containing 1.5 per cent. of phosphorus could be melted in a much shorter time than Mr. Riddell had said, and the smallest articles could be cast therefrom, the degree of superheat being sufficient.

Experiments in Melting Iron

Mr. Riddell said that his equilibrium diagram was built-up in the simplest possible way and he did not believe that the changes took place so rapidly as Dr. Hatfield indicated. He had personally conducted some experiments in melting crucible iron at different rates in order to ascertain the temperature to which he could raise it before it became fluid. But he agreed that the presence of silicon reduced the rate of progress and promoted fluidity in cast iron.

Hot Iron Soft

R. Carrick said he would like to draw attention to certain statements made by Dr. Hatfield. Although he was not a metallurgist he had made thousands of practical tests of cast iron and he had never yet found that the higher the temperature of cast iron the more likely hard iron was to be obtained. He thought Dr. Hatfield might offer, at some future time, a further explanation. Mr. Carrick had tested for hardness with the Brinell and other machines and his own experience certainly did not confirm that statement. He thought most foundrymen agreed that the hotter they cast the iron the softer it would be. Leaving aside the question of chemical content he thought mechanical tests would confirm that theory.

Effect of Temperature

Dr. Hatfield replying to further remarks said that his statement with regard to the effect of temperature was based upon actual experiment and observation, and many of those experiments could be easily carried out. He had found that iron cast hot was distinctly harder than iron cast cold. He could give actual experimental data in support of that statement. His experiments consisted of a gradual increase in the silicon content and he really did the work primarily to see how the results compared with those published by Professor Turner in 1881. He increased the silicon content by stages of 0.25, 0.50 and 0.75 per cent. up to 3 per cent. of silicon, and then he determined the result by fracturing the casting and testing both the combined carbon and the mechanical properties. One thing he discovered was that the gradual addition to the silicon content did not result in a gradual precipitation of the graphitic carbon. In his remaining series of experiments he found that the combined carbon remained at a high maximum well over 3 per cent. until a certain silicon content was reached, and then he found a rapid drop. In that series the casting was done at a fairly cold temperature. In the next series with the silicon contents identical he cast much hotter and he found that the combined carbon persisted until the higher silicon content was reached and that was confirmed over and over again in works practice. If they had a very heavy casting with a sufficiently high silicon the effect of casting temperature would be different because they would always have a maximum softness.

F. J. Cook said that Dr. Hatfield's concluding remarks contained the crux of the whole subject. It was not only a question of hot or cold casting temperature, but also a question of the rate of cooling. When dealing with hard iron which cooled quickly, as for superheated steam engine cylinders, the metal was susceptible to hardness and, therefore, susceptible to the influence of the rate of cooling. If they were not careful they got very hard iron before they were aware of it. If the range of cooling was increased the possibility of softness was increased. He did not wish to throw doubt upon what Dr. Hatfield had said, but personally he had cast thousands of cylinders and there was no doubt that in casting cylinders with metal of the kind he had described at a high temperature they would be more easily machinable than if cast with metal of the same analysis cast cold. That was due simply to the different rate of cooling rather than temperature effect.

SUBSTITUTED METALS IN ELECTRICAL ENGINEERING

A German technical contemporary has been giving some interesting details of the shortage of metals within the German borders, and the steps taken to remedy the evil in the electrical industry. Attempts have been made to expand the restricted supply of zinc by adding other metals, but iron has not given good results. In any case the alloy must contain about 90 per cent. of zinc, and not more than 3 per cent. of aluminum can be added without the risk of pitting. A zinc alloy containing about 6 per cent. of copper and 3 per cent. of aluminum has been found as a suitable material for casting for many purposes, though not for constructional work. For galvanizing with zinc, Schoop's process is used. The melted zinc is sprayed by means of compressed air (3½ atmospheres) in an atmosphere of coal gas on to the iron, which is heated to 70 deg. or 80 deg. Cent. The process may also be available for applying coatings of aluminum, tin, copper, and some other metals. The consumption of tin in Germany is about 21,500 tons per annum, about 70 per cent. of which is lacking, after taking into account the tin recovered from tin-plate waste, etc. For the delivery of this tin treatment with dry chlorine gas has proved the best method, since it converts the tin into chloride without materially attacking the iron. As a substitute for ordinary solder a mixture of 10 per cent. tin, 10 per cent. cadmium, and 80 per cent. lead is recommended. More recently a cadmium solder containing only 2 per cent. of tin and an antimony solder free from tin have been prepared. In 1913 the world's production of aluminum was 78,000 tons, of which Germany produced 15,300 tons. The impurities in the metal, mainly calcium anl aluminum oxide, have now been reduced to about 0.4 to 0.5 per cent. The copper for electric cables has now been replaced by a steel core round which are twisted six aluminum strands. Iron has also taken the place of copper for electro blocks for illustrations, and prophoric alloys containing about 30 per cent. of iron are used with tinder as a substitute for matches.

DEVELOPMENTS IN SHOP EQUIPMENT

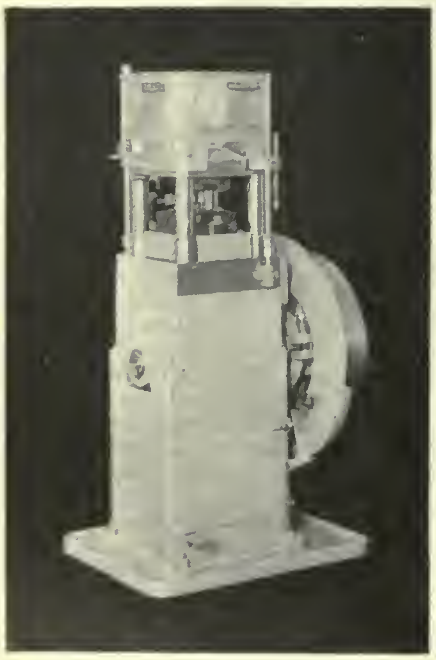
Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

THE WRIGHT DIEING MACHINE

THIS is a new design of machine for blanking, piercing, forming, coining or drawing sheet metal, made by the Henry & Wright Mfg. Co., Hartford, Connecticut.

There being no torsional or ripping strains throughout the machine, the strains being wholly tensile and compressive, the danger of injury to the machine through overloading is almost entirely eliminated; and on account of the fact that it is impossible for the dies to be thrown out of perfect alignment with each other, they should last several times as long as usual, remain sharp for a longer period, giving more perfect edges to the work and in blanking eliminating burrs to a great extent.

The driving mechanism is all located below the die plates instead of above as on the older machines, thus not only doing away with the great obstruction to light, which has always been a fault with these machines, but the machine is in better balance and can be constructed with very much less weight for the same strength as heretofore.



SAFETY CAGE RAISED SHOWING PUNCH AND DIE.

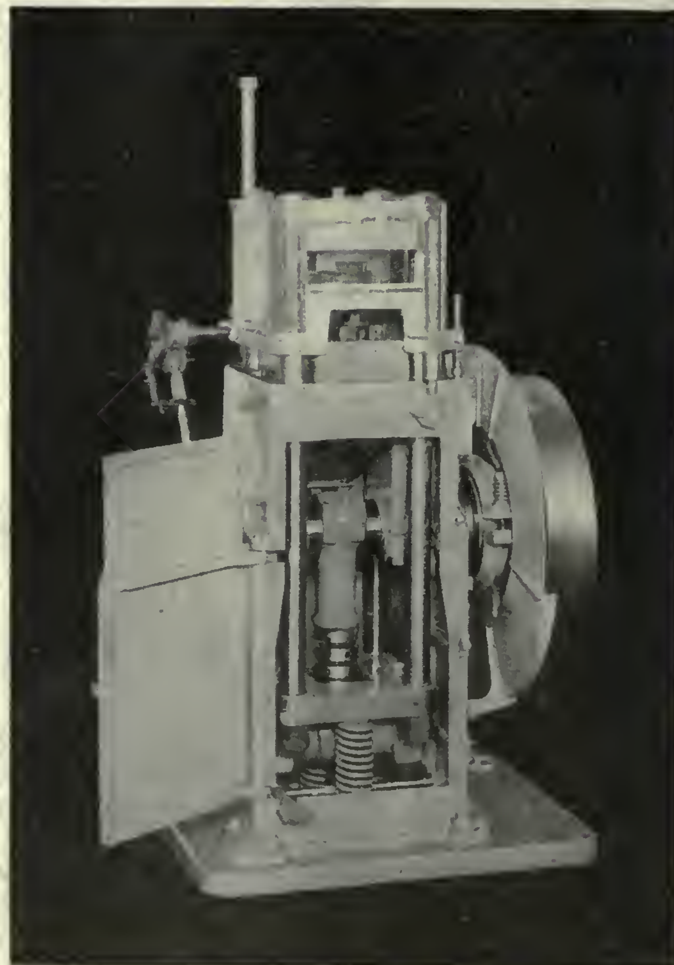
The illustration shows the side view of the machine with the door open, exposing the internal mechanism.

While a simple crank shaft is shown here the patent covers any kind of eccentric mechanism such as a knuckle joint, eccentric train of gears, a cam or any of the known forms of eccentric motions.

This picture also shows the bearings which consist of four inserted bronze bushings at the top of the machine and two cross head guides at the sides of the lower plate.

Springs are also shown which, while not essential, help to make the motion of the machine much smoother than otherwise.

Felt protected dust guards surround each of the four shafts and liberal oil cups are provided within easy reach throughout the machine.



SIDE VIEW OF PRESS SHOWING OPERATING MECHANISM.

The chute is covered with leather in order to deaden the sound of the blanks falling into the chute to a minimum. The design of the machine lends itself easily to the use of various attachments such as finger motions, automatic feeding mechanisms, scrap cutters, dial feeding devices, etc.

As will be readily seen the posts form a natural hub for the attachment of dial feeding devices and there are many ways in which these machines, on account of their very compact design, may be used in groups to advantage over other machines such as the placing of a line of machines under a bench of the height of the dies and run by belts attached to pulleys on a line shaft underneath the bench.

The safety device consists of a cage, shown in illustration, which fits entirely over the top of the machine and this cage must be raised in order to get a hand or finger between the dies and when so raised the machine is locked so that it cannot operate until the cage is lowered, in which position it is equipped with holes sufficiently large for the metal to be operated upon to enter, but not large enough for either the entrance of a finger or hand.

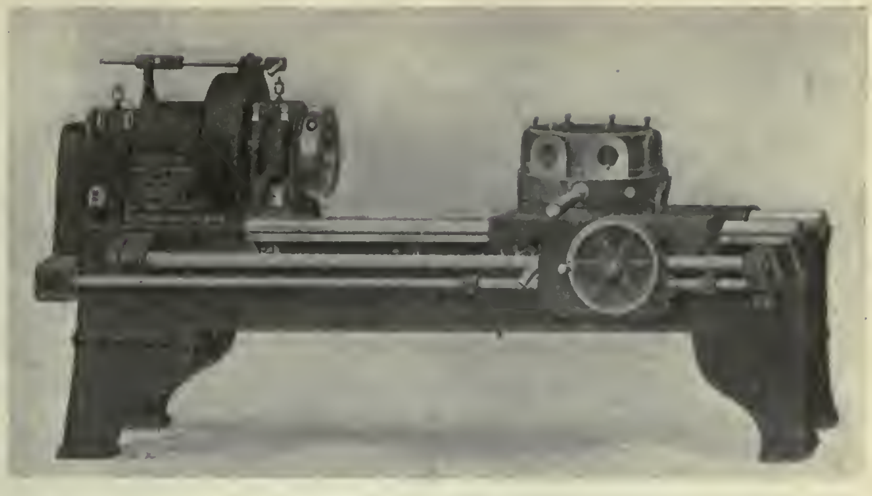
The machine may be operated either from a sitting or a standing position, and the dies may be fed from either one of the four sides as against one or two sides in other machines.

The weight of the number one machine is 1350 lbs., and its rated capacity, 25 tons.

This machine is the latest production of the Henry & Wright Mfg. Co., Hartford, Conn.

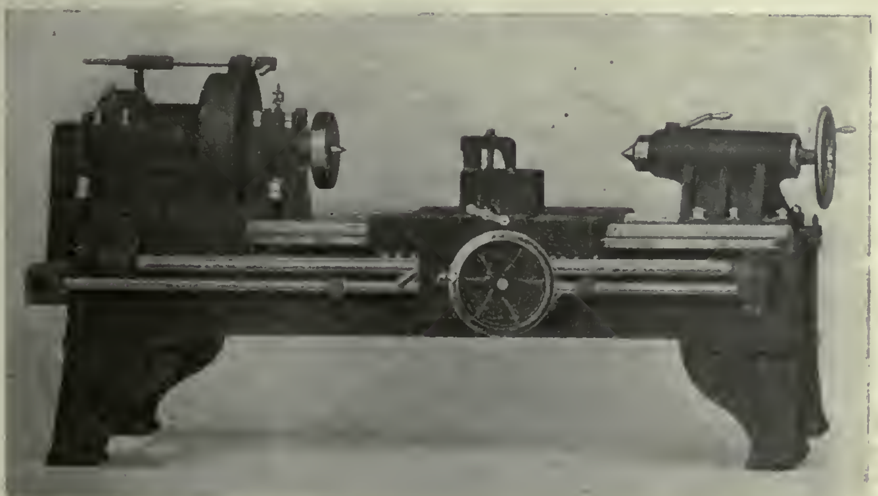
SHELL LATHES

The new lathes illustrated herewith have been designed especially for the heavy work demanded in machining ammunition and are particularly adapted to the machining of 155 MM. and 6 in. shells of class B steel. They are lathes of medium swing and high power, producing a product free from irregularity and with a smooth accurate finish.



SHELL BORING LATHE

The head stock is of the same general design as that of the original Hindman class A lathes. A few changes have been made in this construction which, however, give increased strength and power drive, can be direct from a line shaft through countershaft or the lathe may be fitted for motor drive. Both the shell turning and the shell boring lathes which are illustrated, can be furnished with the single belt drive, tight and loose pulleys running at a speed of 690 revs. per minute and a five inch belt. The loose pulley is fitted with roller bearings and is smaller in diameter than the tight pulley, thus relieving the strain on the shafts when the machine is idle. The spindle is a hammered steel forging, heat treated and ground and is lubricated by means of a well in each cap in which is a sight feed oiler and from which wicks lead from the spindle bearings surface, generously lubricating at all times. The apron is of ample size. This apron contains only two gears which control the hand operation of the carriage in both directions. The operating lever is located at the extreme left of the apron and quick return is accomplished by throwing the operating lever into reverse after shifting the belt from the tight to the loose pulley by means of the lever located at the top of the head strap. By this arrangement the main spindle comes to rest while the machine is operating. The shell boring lathe is of the same general design in some respects as the shell turning lathes but is fitted with a large spindle with a 7½ in. hole which permits the 155 MM. and 6 in. shell forging to be admitted in practically the full length.



SHELL TURNING LATHE

The front of the spindle is designed so that the large screws can be used to hold the shell instead of chucks. This machine is furnished regularly with the six-way turret of simple construction and provided with a powerful and rigid lamp over the entire surface of the turret base. This is sufficient to hold the turret under the heaviest cut. The turret head is of steel casting of ample size to stand all strains.

These shell lathes as described are manufactured by the Duff Manufacturing Company, Pittsburg, Pa.

DRAUGHTSMEN AND FOUNDRY PROBLEMS

By D. S.

The necessity for draughtsmen and engine designers exercising greater care in the design of casting parts of machinery was pointed out by Mr. J. Shaw in a paper read recently to members of the Newcastle branch of the British Foundrymen's Association. The author, in his paper, dealt with the difficulties and worry with which the foundryman had to contend with in the moulding and casting of complicated parts in order to minimise the local internal straining actions set up, due to unequal cooling in the mould. This point is not appreciated as it might be by many draughtsmen in their designs, with the result that many castings of doubtful reliability are made owing to possible internal strains, caused by lack of harmony in their constructive elements. Any sudden changes from uniformity in thickness of metal should be avoided as far as possible; where variations in thickness occur the thicker portion is the last to set and acts as a feeder to the other parts, causing sponginess in the thicker section. Simplicity in structural design should be aimed at in order to reduce the cost of manufacture. The author dealt with the responsibility of the drawing office in facilitating the output in the foundry; considerable thought had in the past been given to decreasing cost and speeding up of work in the fitting and turning shops, but a knowledge of foundry work was essential in order to obtain the best and cheapest castings.

The best preventive of loss in coal storage is to inspect the pile regularly. If the temperature reaches 150 deg. Fah. the pile should be carefully watched, and if the temperature rises to 175 deg. or 180 deg. Fah. the coal should be removed as promptly as possible. The coal should be thoroughly cooled before being replaced in storage.

* * *

A VALUABLE rust-inhibitive coating for general priming of finishing work may be prepared from sublimed blue lead. The use of two parts of blue lead and one part of linseed oil containing about 5 per cent. of turpentine drier makes a paint of the right consistency. This may be purchased in prepared form. When this paint is used for top-coat work in marine exposures—battleship gray—the addition of 1 per cent. of carbon black to the blue lead aids in the maintenance of the colour. The rust-inhibitive value of this pigment is due to the high percentage of lead oxide litharge.

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The Foremen That Are Wanted

HERE'S a rather unusual advertisement that appeared in the advertising columns of this paper:

"Foreman wanted for stamping and drawing department, also one for art metal department. Men with technical ability who are willing to keep up-to-date by reading the technical press preferred."

Rather unusual, isn't it? You never read an ad. where a man was wanted for a responsible position "who reads all the new fiction and is thoroughly familiar with the sporting pages."

It's just a good plain indication of the drift that has set in aimed at hundred per cent. efficiency. Firms realize that methods that were fine when their mechanics learned their trades are rusty with age now and as obsolete as a good, old-fashioned pumpkin pie. They want men in their more responsible positions who are keeping up to the newest developments. If there is a new method of performing a certain operation brought out, they want their men to know it. If there are parts of their plant that have served their day and generation and are not capable of keeping up with the competition of more modern plants, in justice to their own trade they want to know it. They cannot know it if the men in their plants do not keep up to the minute. And there's only one way to keep up to the minute, and that is by reading the trade and technical papers.

There are scores of good mechanics in responsible positions who read papers such as CANADIAN MACHINERY. They read the ads. as well as the other pages and they do so with good reason. The advertising in this paper gives them a line on all the new machinery that comes out, and there is always material with it of a descriptive nature that describes just why the machine is good and why it should supplement others that have been on the market.

After the war, more than ever, Canada will need efficient men to man our shops, if we are to hold our own in the commercial war which is almost sure to follow. Manufacturers owe it to the nation as well as to themselves to produce men as highly skilled and educated as possible. And the mechanics no less should be on the alert, quick to study and assimilate information pertaining to modern practice and new equipment.

It cannot be expected that present high wages will continue after war business is over. The race then will be not so much to the physically strong as to the mentally fit.

What Kind of Horse Will You Eat?

AND now there's a good-sized agitation on to have horse meat sold in Canadian stores. The supposition is, of course, that after being sold from the stores, people will eat the horses.

Well, if we're going to eat the nags let's get off to a good and proper start, thusly:—

Undertakers and pacifists eat black horses.

Sailors eat bay horses.

Orangemen, be sure to ask for a wing roast from a white King Billy horse.

Designers or draughtsmen insist on getting your cuts off a draught horse.

Shipbuilders should find out the days when their favorite shop will be able to serve them with a chunk off a good old worn-out Clydesdale.

By all means if we're going to eat horses, let's go at it right. Get the bit out of your mouth and the blinkers off your eyes and buy intelligently.

U. S. Govt. Tackles Labor Problem

STRIKING machinists at Bridgeport, Conn., refused to go to work following a board of arbitration considering their case. The result was the adoption of federal control of labor. This means in short:

(1) The Government will take over and operate plants where employers decline to abide by awards of the War Labor Board;

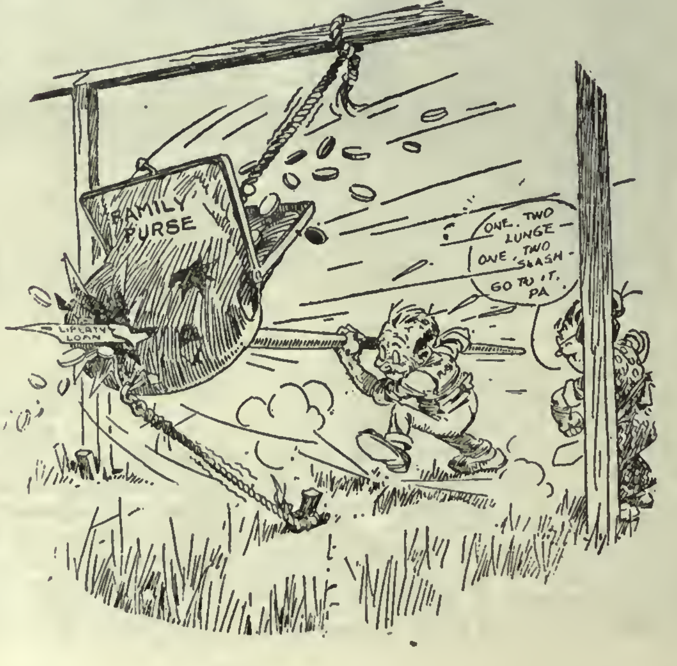
(2) Striking employees who ignore these decisions must return to work or be barred from any war industry shop in the country.

As the war industry shops are the only places protected by the Government against the draft, it means the putting into force in reality of the "work or fight" principle.

It takes a courageous Government to tackle a labor problem. The reason is clear: votes are at stake, and to the average government the next election is the greatest thing in the world.

In Canada we have had for a long time a surplus of arm waving, fist shaking and tub-thumping, but mighty few brave, disinterested moves having in view simply the welfare of the community at large. United States has gone in where Canada fears to tread.

ORDERS have gone out that no more beer is to be made in U. S. after Dec. 1. Old John Barleycorn has been steam rollered, assassinated, murdered and buried. And yet folks seem to collect enough stuff under the belt occasionally to make 'em wobble.



Chasing Up Produce Prices

HERE'S a clipping from a Toronto paper in reference to the Saturday market in this city:—

> Butter and eggs were plentiful, but Madame Farmer is fast raising the prices in order that they will reach the $1 a dozen price by Christmas. Eggs were 55 and 60 cents a dozen, while one woman who had a basket of large-sized ones asked 70 cents.

The government can regulate the price of wheat, of steel and many other lines. It can tell the steel mills what they can charge the jobbers, and the price the jobbers can charge the consumer.

But the price of butter and eggs jumps every time the old hen cackles and every time the hired man puts the three-legged stool down beside the brindle cow.

It may be that the man in the city does not understand the problem of the man on the farm. But it is painfully certain that the farmers are out of touch with the situation of the limited purse in the city when they persist in regarding the basket of produce as a blunderbuss in their hands to chase prices still farther up the high price tree.

Be a Tin Can Patriot

THE tin can has come to be quite a topic of conversation. There used to be the tin can that was tied to the dog's tail, and later there was the tin can that served in the shinny school where the hockey stars of later days were turned out.

But the tin can isn't nearly as important as the tin that's in it.

So the can's being tied on the tin can.

Every time you buy something in a wood or board container that used to be done up in tin, and don't grouch about it, you've become a tin can patriot.

And every time the tin can patriots save 1,000,000 two-pound tin cans they've provided the material for a mile of 85-pound rails.

So if you can not do anything more dazzling you can be a tin can patriot.

The policemen in Toronto are going to form a labor union. Well, why not make it a branch of St. Patrick's society?

* * *

They may cut off the supply of cars, and they may stop runnin' them, but don't worry. You'll soon be able to crawl down the cellar stairs and keep in form by cranking the furnace.

* * *

IN an election at Canmore, Alberta, an Austrian defeated a returned soldier in a school trustee contest, and there was only a sickly looking attempt to conceal the jubilation of the foreigners at the win. And it must be remembered that it is on this foreign labor that the West is depending for its supply of coal.

* * *

THE manager of one of Toronto's restaurant concerns stated that under the new food regulations they would save 50 pounds of sugar per week. Very nice. But is that taken to mean that the restaurant keepers will simply buy that much less and sell their meals at the same old price? If so the restaurant keepers will have cause to rise up and call the Food Controller blessed.

* * *

THERE is an agitation on to raise the price of milk in Toronto to 15 cents per quart. Farmers say they are not making money at present prices. It beats the band how farmers keep on paying off mortgages and buying motor cars and all the time losing money. On the dead level if there's a farmer who will own up to the fact that he's makin' money, will he please stand up on the bench so we can all have a look at him.

They Tied a Can on Him

HE learned his trade long years ago inside a little shop, he graduated with a whirl, a skip, likewise a hop. He was a dandy in his day, he learned things powerful quick, they 'lowed he'd slide along in haste and show them all a trick.

He knew about a lathe, he did, this whistlin' chap called Bill, he knew about a planer and he knew about a drill.

He learned the good old ways, he did, of doin' this thing and that, and stowed his knowledge in his dome way up beneath his hat—and he reckoned that the way he knew was quite the best on earth, and things he didn't know or do had neither good nor worth.

And so he went into the world to earn his daily bread, by sellin' out to other folks the stuff within his head.

But he didn't stop to grab no more, he didn't seem to think that stuff he learned long years ago might soon be on the blink. He hee-hawed at the chaps who worked and read books in the night, that they might keep their notions straight and know what things was right.

He had a snort for every kink that brighter minds had made, he wouldn't budge from what he learned in pickin' up his trade.

And other chaps went past this jay, they had the quickest way, and they'd do in just an hour or two what he'd fuss at all day. And yet he wouldn't take the choke and get himself in shape, he was just standin' still, by heck, this wise and knowin' jake.

This thing went on for years it did, he wouldn't budge an inch, he wasn't wise enough to see the comin' of the pinch. The firm he worked for watched this jay, he'd neither go nor vim, so they came along one day, they did, and tied a can on him.—Ark.

We've been saving daylight all summer, but we'll be blowed if we've got any more of it now than when we started.

* * *

SUGAR regulations have it now that one spoonful must do a meal. All of which makes us long for the good old days when we used to chuck in three heapers and then make a small whirlpool in the teacup to dissolve the stuff.

Kaiser to Austria—Now then, up you go.
—Punch.

MARKET DEVELOPMENTS

Much Harder to Secure Material at U.S. Mills

Canadian Warehousing Interests Are Running Pretty Close to Depletion in Spots—Big Orders in Montreal Will Call For the Erection of a Million Dollar Factory

THE placing of new orders in Canada for munitions, ordered by Washington, again brings this business prominently to the front. It is hardly necessary to do this, because the munitions operations comprise the greater part of the industry now moving in the Dominion. New contracts in Montreal will amount to about ten million in one shop, and a million dollar structure will be rushed up to house the new undertaking. Canada is moving in millions at present in a way that would have seemed impossible a few years ago. The capital expenditure in this case will be guaranteed by the government placing the business.

Things are not bright for Canadian firms securing material from U. S. points. Several of the largest houses in Canada that are in the warehousing line have had men at the U. S. mills trying to find out where they were at and they received very little satisfaction. As a matter of fact Canadian jobbing trade has now to depend largely on the connection it has built up with United States mills in years gone past. The rating given this class of trade is B-4, and that means practically nothing at all in the way of compulsion or obligation that the mill can be held to. There will have to be a more definite understanding soon. Canadian trade in sheets is being supplied largely from the smaller mills in United States that cannot be taken off sheets and turned over to plate because they can't roll anything but sheets. As a matter of fact these places are in better shape to make money than the big mills that can be converted to plate rollers.

There has been another cut made in the amount of basic material that can be turned over to the tin mills. There is a great need for rails at present. The war and the work at the mills follow very closely together. There is a feeling that there will be a big call for rails on account of the advance of the Allies, and the need for bringing up heavy artillery. Therefore every energy is bent at American mills to the turning out of rails. Every time they succeed in saving the material that would go into the making of a million two-pound tin cans they have provided for the manufacture of a mile of 85-pound rails.

Trade is brisk in supplies. There is small chance of any house accumulating a surplus of high speed steel at present demand. Prices remain firm, but have not gone up. In fact there has not been an outstanding price change during the week.

BIG ORDER FOR MONTREAL GIVES NEW START TO BIG BUSINESS

Special to CANADIAN MACHINERY.

MONTREAL, Que., September 16, 1918.—Further stimulus was given to the munitions activity during the past week by the announcement that one of the large local plants had just received a contract from the American government for large shells, the value of which will run close to $10,-000 000. The new addition that will be required will entail an expenditure of about $1,000,000, this to be guaranteed by the U. S. government. It is not unlikely that other contracts may be given to those firms in a position to manufacture the desired shells on a stated basis of production. These developments have acted as a stimulant to trade generally and business shows improvement in many directions. Dealers in machine tools report a noticeable increase in enquiries and sales have been better during the week. Difficulty is still experienced in obtaining equipment from American points, particularly in those tools used for the manufacture of munitions. Trading in old materials has been remarkably quiet, no doubt as a result of present festivities in connection with the Jewish New Year.

Steel Shortage Still Pronounced

The general steel situation is still marked by the evident shortage of material and possible relief in this connection is very uncertain owing to the excessive requirements for essential war purposes, at least this is the argument invariably advanced by the producer when orders are placed at the mills. With the possible exception of some of the lighter and lesser used shapes the dealers' warehouses are almost depleted of material and ruling regulations hold out little hope of acquiring stock for early future demand. This condition will eventually result in many essential war undertakings finding it very difficult, if not impossible, to obtain steel for emergency repairs or alterations. This is a feature equal in importance to supplying material for manufacturing purposes, as the latter cannot be achieved unless the former is taken care of. Steel shipbuilders are obtaining supplies in fairly large volume but not in sufficient quantities to meet maximum requirements. Transportation conditions at the present time are quite satisfactory and delays are more a question of production than railroad troubles.

Speaking on the fuel situation one large dealer here stated that conditions this winter would in all probability be less acute than those experienced last winter owing to the better organization of railroad facilities for handling the country's business. The uncertain factor appears to be developments that might arise at the mines that would result in reduced output.

Steady Tone in Metals

With the exception of tin the metal situation is steady in character with the demand normal and the supply adequate.

Copper continues firm at the set price of 31 and 32 cents per pound. Tin is coming through in greater quantities and increased regularity, and in consequence the situation is showing marked relief with prices declining; dealers are now asking 95 cents to $1 per pound with still lower levels in prospect.

Supplies of spelter are equal to the demand and prices are steady. Lead is strong with the supply light and quotations are very firm at 10½ cents per pound. Antimony and aluminum are firm and unchanged at last week's quotations.

Interest Renewed in Machine Tools

As a consequence to the placement of additional large orders for American shells, the renewed interest that has apparently developed in machine tools has been a feature of the week's transactions. Inquiry for new equipment has been quite pronounced and the demand for used machinery of a shell making character has shown an increase. Conditins in the States make it increasingly difficult to place orders and definite delivery is next to impossible. Many Canadian tool builders are so filled with regular business that special work in the way of shell machinery cannot be accepted. Increasing demand for machine shop supplies is a steady factor of present activities. The sales of high-speed and other tool steels have been a little lighter but the average is well maintained.

Little Doing in Scrap

An influencing factor in the present quiet condition of the old material situation is the New Year celebrations of the Jews, an event that generally prevents ordinary activity in this line. Trading is about normal with the bulk of the business in heavy melting scrap and machine cast iron, the latter, however, very often hard to obtain owing to the heavy requirements. Much of the scrap in connection with the production of munitions seldom passes through the hands of the dealers as the producer of scrap in many instances is also the consumer, and where this is not the case the material is shipped direct to the furnace plant without the intermediate handling by the dealer. Prices have shown some slight fluctuations during the week but generally quotations are the same as last week.

POINTS IN WEEK'S MARKETING NOTES

The most conservative estimates in U. S. place the steel shortage for the last half of 1918 as four million tons.

Big wire plants are being remodelled in order to produce shell rounds instead of wire rods.

A large number of rails are being called for in U. S. war plans, this leading to the belief that a considerable advance is planned which will call for rails to carry up big guns.

Tin plate mills have been informed that they must cut down 30 per cent.

Canadian warehouses are given a B-4 rating by U .S. mills, which carries no obligation on the part of the mill.

U. S. mills rolling sheets have been ordered to still further reduce the amount of material they are taking from the furnaces for this purpose.

General Pershing calls for 100,000 3-inch shells per day. This is in addition to the volume of munitions business that is being carried on.

Strikers in U. S. war shops who refuse to abide by the decision of the War Labor Board are barred from working in other war work plants. Firms refusing to accept awards or refusing to meet their men will have their plants taken over and operated by the U. S. Government.

KINGSTON'S GAS TANKS NOT UP TO CAPACITY

And There Are Prospects of a Serious Shortage There During This Winter

Kingston is confronted with an uncomfortable gas situation. The present storage facilities are inadequate, as can very easily be understood when it is realized that they have not been increased for more than ten years. A new gas holder was to have been in operation last December, but owing to war conditions affecting labor, the contractors failed to fulfil bargain to have the excavation completed at a certain date, and the Utilities Commission, acting under the advice of its expert, Frederick Burnett, of Toronto, refused to permit the concrete work to be proceeded with lest it be damaged by frost. General Manager Folger then has to juggle along as best he can to supply the people with gas throughout the winter and spring. The work of constructing the concrete foundation of the gas tank was proceeded with late in the spring, but when the concrete was tested it was found to leak, and the Commission refused to accept it. The contractors have now lined the interior of the tank surface, and are satisfied it will stand the water test, but it appears doubtful if the Commission will accept a patched piece of work. If it does not accept it, the concrete will have to be blown out and replaced, and several months will be lost, precious months, for fall is at hand. To tide over another winter with the present gas facilities is going to be some job. The people had a taste of gas shortage in early September, when the supply gave out Friday evening at six o'clock, and continued off until Saturday morning.

CANADIAN STOCKS MAY YET RUN LOWER

U. S. Points Not In a Position To Send More Material to the Dominion

TORONTO.—Some Canadian dealers who have been at U. S. points do not bring back glowing reports of the chances of this country receiving increased supplies of raw material from United States points. The war program at Washington is staggering in its size, and compelling in the way in which the authorities are adhering to it. This program has precedence over all else, and it means that unless production is greatly increased the war appetite is going to crowd some of the less necessary business into the ditch.

Shell plants in Canada on American business are doing well in the matter of deliveries, although there are a number of places where operations are not yet under way.

Condition Is Not Hopeful

Those Canadian firms or houses that have been looking forward to something beter in the way of supplies from U. S. points have been living in a false atmosphere. The plain fact is that the war program of United States increases every twenty-four hours. The war looks bigger to them every day, and they are expending their war orders in proporions in keeping with this view.

Mr. Near, of Drummond-McCall, spent the greater part of last week at U. S. mills from which they have for years drawn a great share of their stock. 'Things are looking worse than I ever anticipated," remarked Mr. Near to MACHINERY. It seems to make no difference whether an article is on the embargo list or not, the government has its eye on it all the way through, and is determined to see that it goes to a war purpose shop and no place else. Previously Canadian warehouses have been getting sheets lower than 1-8" quite readily, but it seems unlikely that this condition will continue for any length of time. The best rating that is given to warehouse orders is B-4. They give that rather than a direct turn-down. A B-4 rating depends entirely on your connection with the mills. As a matter of fact it is becoming a saying among the mill men when they are approached by the warehouse men 'I have an A-1 desire to serve you but only a B-4 ability.' The arrangement as it stands at present gives the advantage entirely to the mills.

May Get Less In Future

"It looks as though there would be no increase in the allotment of material for this country. In fact, it really looks as though there might be a considerable cut in the volume of material for the Dominion. The sheet situation is causing not a little worry to a good many of the Canadian houses. There is a queer situation just at the moment. The big mills that can convert from sheets to plate have been ordered to do so by degrees. The first move was that 25 per cent. less billets should go to the sheet mills, that material being turned to the plate rollers. Now there has been notice sent out, and it will be operative in a few days from this, that another twenty-five per cent. shall be taken for the plate producers. The little mill that cannot turn over to anything but the rolling of sheets is left more alone, and to-day there is more money in the turning out of sheets than in the making of plate. That condition is not likely to run much longer, and it is these purely sheet mills that have been looking largely after the Canadian trade in that particular line.

The Vulture Is There

"There was one mill man in Pittsburgh," continued Mr. Near, "who gave me a pretty good outline of the demand for steel. He stated that there were jobbers hanging around there all the time in the hope that there would be a little over on the order of some firm that they might have a chance to buy. They also have the hope that there may be some half-spoiled material coming from the rollers that will not do for contract work. They hang around here for these pickings like a lot of vultures most of the time. Anything that is steel—that is about the extent of their specifications. He laughingly compared this to the specifications that the Canadians brought down, expecting to get them attended to at the mills at once. The Emergency Fleet board has a faculty of sending out specifications for a lot of work that has been very carefully worked out in advance and which requires an immense amount of care in the mills. There is generally a grand scramble to see if this particular order can't be loaded on to some other mill.

Have No Ruling

"As a matter of fact," concluded Mr. Near, "the Canadian warehouses have no ruling or standing at Washington. We are now, and have been for some time practically at the option of the mills as to whether we keep going or run out of stock. The trade is gradually working into a narrower margin and I can't see anything that would make me believe that the situation is likely to be relieved in the near future."

CEMENT CO. HAS A BIG MUNITIONS ORDER

And Work Will Be Started Very Shortly on Building of the Plant

The Canada Cement Co., Montreal, have recently received a munitions contract from the American Government, the total value of which will approximate $10,000,000. A new plant will be erected to cost about $1,000,000, the outlay to be guaranteed by the U. S. Government. The work involved will include the furnace production of the steel, the making of the billets, the forging and machining of the shells. Operations on the new plant addition will commence almost immediately.

GEN. PERSHING KEEPS U.S. DIZZY CALLING FOR MORE SUPPLIES

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., Sept. 19.—General Pershing wants at least 100,000 3-inch shells a day. As this is entirely apart from his requirements in other sized shells as well as such shells as the United States might be able to make for Britain and France a very large proposition is presented and the Ordnance Department is pushing hard on the semisteel shell program. Last week a meeting was held in the Pittsburgh Chamber of Commerce auditorium, attended by 300 representatives of foundry and machine shops in western Pennsylvania, eastern Ohio, West Virginia and Western Maryland. Representatives of the Ordnance Department stated that they wanted 33,000,000 semisteel shells during the next ten months and insisted that more than half of the total ought to come from this district. It was urged that even those who could perform only part of the work on a shell participate, machine shops without foundries attached being expected to take hold as well as foundries. The semisteel shell program includes as minimum requirements, in addition to orders placed, the following: 1,500 daily 12-inch high explosive; 5,000 daily 155 mm. shrapnel; 35,000 daily 155 mm. high explosive; 80,000 daily 75 mm. high explosive. Prior to last week's meeting 31 representative foundrymen had visited the American Radiator Company's plant at Buffalo, where there is now a daily output of 100 6-inch shells, with prospects of largely increased output in the near future. Representatives of the Ordnance Department stated at the meeting that the specifications would be made as simple as possible and that every effort would be made to assist manufacturers taking up this line of work.

Shell Steel and Rails

The demand for such large numbers of semisteel shells does not mean that there is any relaxation in the pressure for regular steel shells but of course, it shows that the total shell requirements have become so large that it is out of the question to meet it with steel shells alone. Rails and shell steel have come into sharp competition, because there has been a considerable production of shell rounds at rail mills and rail requirements having lately increased very sharply it is impossible to increase shell steel production at such plants and decreases might even be necessary. The recent decision to remodel two wire plants, Donora and Woodlawn, to produce shell rounds instead of wire rods, will eventually help. In addition to the 150,000 tons of rails ordered a few weeks ago for the A. E. F. it is understood there are large additional requirements, occasioned by constant advances in the battle line. Possibly the Franco-American drive initiated last week, whereby the St. Mihiel salient was promptly wiped out, has something to do with this, as large guns will have to be brought forward if the Metz fortifications are to be attacked, and the gun movement would require large quantities of rails. It has been known in the steel trade in Pittsburgh for months that the French have had large guns ready for a long time past against the time when activities should be initiated at this point. The steel trade, it may be mentioned, is naturally particularly interested in this phase of the military operations, seeing that its objective would be the control of the Minette ore district from which Germany secures nearly its entire supply of steel.

Tin Gets Another Cut

As a means of saving steel the War Industries Board has ordered, for the fourth quarter of the year, a 30 per cent. reduction in the supply of sheet bars to the tin plate mills, and it chances that the major portion, if not all, of the curtailment will be at the Edgar Thomson steel plant of the Carnegie Steel Company, which by reducing its output of sheet bars will be able to make correspondingly more rails. Last May a precise allotment of sheet bars to each tin plate plant was ordered, a definite weekly tonnage per mill, whereby there has been an absolutely full supply of steel for the tin plate mills, to insure a full supply of cans for the perishable food crops. This now being taken care of, it is feasible to reduce the output of tin plate. After January 1 the allotment will no doubt have to be increased. The saving in steel in the three months' tin plate curtailment will be between 125,000 and 150,000 tons. As a measure of comparison, it may be mentioned that one mile of track in 85-pound rails involves about the same amount of raw steel as 1,000,000 two-pound tin cans.

Apart from the rail requirements for the overseas military operations, Director General of Railroads McAdoo wants 60,000 tons of rails a week for replacement on domestic roads and for building new track. In the steel trade it is considered impossible to meet such a demand, but in the past few weeks the deliveries have at any rate been much heavier than formerly. Mr. McAdoo was in Pittsburgh last week in his inspection of railroad conditions and he summoned to meet him here A. W. Calloway, manager of bituminous coal production for the Fuel Administration and J. Leonard Replogle, Director of Steel Supply for the War Industries Board. The motive was obvious. The Fuel Administration wants more coal to be produced and calls for more transportation facilities, while the Railroad Administration in turn wants more steel from the War Industries Board, hence Mr. McAdoo brings Mr. Calloway and Mr. Replogle together.

Other Steel Restrictions

The only precise fresh restriction in

the use of raw steel in finishing departments is that mentioned above in the case of tin plate. Other restrictions are being considered, relating to the use of steel in merchant bar mills, pipe mills and wire mills. In the past few weeks these three classes of mills have been operating at an average rate of not more than 60 per cent. of capacity. Possibly decision in these matters will be aided by the inventory now being made of stocks of steel in the country, as a result of a questionnaire recently sent out by the Census Bureau in behalf of the War Industries Board, whereby steel producers, finishing mills, jobbers and manufacturing consumers are required to report their stocks in detail. Some stocks may be found that can be utilized for distribution to plants engaged in war work.

Production

The monthly report of the American Iron and Steel Institute indicates that steel ingots were produced in August at the rate of about 40,300,000 gross tons a year, against rates of 42,250,000 tons in July and 43,500,000 tons in June. The June rate was the best on record, barring only the rate last October. The July and August decrease reflects summer weather, particularly the record hot weather that prevailed in the central west during the first 12 days of August. On the whole, the midsummer drop in production was less than usually occurs, and there is good reason for expecting the June rate, or a higher rate, to be attained this month or next. Already there are reports of individual mills doing much better thus far this month than in the corresponding period of August. Some statistics gathered last May indicated an output of finished rolled steel equal to 78 per cent. of the production of ingots. Prior to the war the proportion was almost constant at about 76 per cent., the loss being in roll scale, scrap, etc., practically all of which is recovered. When shell steel manufacture for the Allies was undertaken the proportion dropped a trifle, on account of the heavy discards, but now it appears that some relaxation in the specifications, more skill on the part of the mills, and the employment of discard steel for various war uses are having their effect in pulling up the percentage. Using this factor, the ingot production in July and August would point to the production in the two months of about 6.000.000 net tons of finished rolled steel. This is to be considered in connection with the War Industries Board's recently increased estimate of 23,000,000 net tons of steel being required in the half year, with its very conservative estimate that only 17,000,000 tons production could be counted upon. If the two midsummer months produce 6,000,000 tons the half year ought to show at least 19.000,000 tons. This would still be 4.000,000 tons short of the estimate and the less important of the commercial uses, recognized as helpful in winning the war, cannot be allowed much steel.

U.S. MAKES DRASTIC MOVE RE STRIKERS

Will Insist Upon the Acceptance of the Work or Fight Rule in Every Case

Special to CANADIAN MACHINERY.

NEW YORK, Sept. 19th.—War industries in various parts of the country are constantly buying machinery. The greatest activity is in the Central West. The barred industrial zone has shifted the heaviest buying from the Eastern section. The Government is still buying tools and cranes directly, but the largest orders are being placed by private makers of guns and ammunition. Shipbuilders and manufacturers of railroad equipment are placing additional contracts and some large orders are still pending.

Labor strikes affecting war industries have finally brought drastic action by the President. The Federal policy of industrial war-labor control was determined upon as a result of the refusal of striking machinists at Bridgeport, Conn., to accept an arbitral decision of the War Labor Board. The new policy applies to both employers and to employees and may be epitomized as follows: First, the Federal Government will take over and operate the plants of employers who decline to abide by decisions of the War Labor Board. Second, striking employees who ignore or temporize with these decisions must return to work or be barred from employment in any war industry in the community in which the strike occurs for a period of one year and face rejection of any claim for exemption from the draft law based on usefulness in war production.

One Result

The plant of the Smith & Wesson Co., Springfield, Mass., which has been making pistols for the Government, has been commandeered by the War Department as a result of the Government's industrial policy above outlined; also, many strikers at Bridgeport have returned to work while other machinists unwilling to resume their old places are seeking employment at war industrial plants elsewhere.

In the Central West, especially at Chicago, labor conditions, which were going from bad to worse, are expected to be improved immediately by the President's action. In several cases, adjustments of difficulties have come before the War Labor Board. If decisions of the Board are rejected, the "work or fight" mandate will be put into effect.

The American Brake Shoe and Foundry Co. has come into the market for 150 tools to be installed in its Erie, Pa., plant for the manufacture of guns; the list includes 100 plain and vertical milling machines and 50 8-inch, 20-inch and 24-inch lathes. The Government has

THERE'S A BIG GAP UNFILLED IN THE AMERICAN SCRAP TRADE

THERE seems to be no let-up in the demand at U.S. points for scrap metals. Canadian yards on the other hand are well filled, and consumers here are being much better supplied with this material than those who are depending on U.S. markets. The embargo is still on in this country and Canadian yards are not allowed to ship certain grades to U.S. points. The situation in U.S. at the leading points is described in the following despatches—

Chicago.—A very large demand for heavy steel scrap is being received from Eastern points, but permits are not being issued for this material to leave this district.

New York.—Dealers here report that there is a very brisk demand practically for everything they have to sell, and on account of this, and also on account of the fact that very little material is coming out, prices remain firm at the Government maximum.

Pittsburgh.—There is no question but that users would absorb a very large amount of scrap over and above that which they are receiving were they able to secure it. The open hearth furnaces have benefitted to a very large extent by the embargo which has prohibited turnings from going to the blast furnaces.

Cleveland.—There is a good demand for heavy melting steel, turnings and low phos. are the scrap and iron and steel grades that are most wanted. There are numerous complaints being made over the car service, and deliveries on orders are rather indifferent on this account.

Cincinnati.—The price being paid now for labor in the scrap yards very seldom gets a chance to go below the 40 cents an hour mark. Some of the dealers here are inclined to be somewhat pessimistic about the future because the small dealers are not sending in anything like the amount of stuff that they have done in the past.

Philadelphia.—There has been some controversy going on here in regard to the standing of the scrap industry under the new draft regulations. Dealers however, are inclined to call attention to the ruling of General Crowder, in which he recognises the fact that the scrap industry was essential, and on this ground it is quite proper for dealers to claim exemption for any men they may have working in their yards.

Buffalo.—There is small chance of any of the dealers here accumulating any reserve stock against the winter months, when it will not be coming in as freely as it is now. All the tonnages that show up here are immediately absorbed by the trade.

Complaint is made that the high cost of labor leaves little incentive toward trading on the ground that since the Government prices were fixed there is little opportunity for the trade to make any money. There is a very keen demand for heavy melting steel, and in fact for any other heavy grades.

placed additional orders for guns and shells, and as a result several new inquiries for round lots of machine tools have been put out, including one for 50 tools and another for 25 machines for making guns and gun parts. Non-essential industries that are now preparing to manufacture airplanes, escort wagons and other war munitions have been actively buying small lots of wood-working machines in the Cleveland, Ohio, district. The Winchester Repeating Arms Co., New Haven, in preparing to double its output of ammunition, will purchase $500,000 worth of shop equipment, but orders will not be placed until sanctioned by the Government. The large purchases contemplated by the Baldwin Locomotive Works are still pending. The Baltimore Car & Foundry Co., a subsidiary of the Standard Steel Car Co.. will expend one million dollars for building and equipping a fabricating shop which will be utilized in shipbuilding work.

The Navy Department will make purchases of a number of machines for the large structural shop which will be built at the Mare Island Navy Yard. Bids have been taken on 6,200 tons of steel for this plant and it is expected that an award soon will be made to a. Pacific Coast builder. The Department has taken over the Harrison, New Jersey, plant of J. J. Spurr & Sons, which will be equipped for assembling and installing machinery in submarine chasers and other boats now being constructed at the Brooklyn Navy Yard.

The Ordnance Department has placed a number of orders with various manufacturers for 80-inch lathes and preparations are being made for the purchase of 102-inch lathes to be used in the manufacture of guns at Government arsenals.

IRON TRADE IS LOOKING TO LAST QUARTER FOR MORE MONEY

THE iron trade is, of course, greatly concerned over the meetings that are being held now looking forward to the fixing of prices for the last quarter of 1918. The producers of pig iron are pressing their claims for consideration, and they will certainly draw attention to the widening gap in production costs in various districts due to higher ore, freight charges, and other considerations. The demands at all points for steel making iron are referred to as being intense, munition production calling for a greater output than as heretofore seen possible.

Reports from the leading centres on the American continent are as follows—

PHILADELPHIA—The dealers here are showing considerable interest in the forthcoming action by the government on prices. Producers from here are in conference at New York. There is a feeling that the War Industry Board may not be inclined to allow any increases in price for this year, but it is certain that the producers will press the point, and make a strong try for prices on a higher level.

NEW YORK—The 1919 situation remains rather uncertain here, and it is worthy of notice that the present system of allocation is causing some rather peculiar situations, as in some cases producers are being given tonnages of iron for consumers with whom they had previously broken off trade relations, and whom under ordinary circumstances they would have no intention of supplying. Under present conditions though they have no choice in the matter. On the other hand they are many producers who are not able to take care of those firms who have been good customers of theirs in the past. Speaking of prices some of the southern furnaces have experienced the 250% increase in the freight costs on raw materials, while labor and other costs have risen materially, and it is certain that these interests will press for higher prices.

PITTSBURGH—There is no question but that inquiries here are numerous enough, but very few contracts are entered into, in the fear that they may in some way interfere with the Government distribution of the supply of iron. Production is coming along nicely, and there might be quite a large increase were it not for the fact that the coke continues to be of a poor quality.

BUFFALO—There does not appear to be as far as can be ascertained any 1919 contracting going on now. In fact, the trade seems to be waiting until the new classification of industries is given out.

CHICAGO—It appears that there is going to be some trouble in store for those melters who have not made out the reports covering their receipts and consumption of iron during the past month, and it may be that they will get no supplies whatever. Strict instructions are issued to furnaces and delegations to regard these industries as unessentials. They automatically enter that class when they neglect to send in their reports.

CINCINNATI—The great stove trade in this city and district is in a peculiar situation just now. So far the stove foundries have been able to operate, but if latest reports are correct they are going to have a hard time of it during the first half of 1919 in which they will have little or no iron at all.

ST. LOUIS—To get some conception of the position of some of the non-war plants, in regard to the supply of iron, it may be mentioned that some of the largest of them are now announcing that they are now in the market to take contracts from any plants that have Government work. For instance the Buck's Stove and Range Co., one of the largest in the U.S., are advertising in the daily papers, soliciting work from other manufacturers in the lines in which they specialize. They state that the curtailments in the matter of fuel, iron and steel have cut down their output to a very small amount.

SYSTEM OF CONTROL IN ENGLAND NOT UNLIKE THAT OF THE STATES

THE system of controlling the iron and steel industries in this country is well known, but not so much has been said about conditions in England. The following factshave been forwarded to CANADIAN MACHINERY in this connection:—

"In order to ensure that supplies of steel as far as possible be forthcoming for the most urgent work, a system of control of rollings has been instituted. The country has been divided up into six areas, each of which has been placed in charge of a Steel Superintendent, who represents the Admiralty and the Ministry of Munitions. One of his chief functions is to advise and assist firms within his area to obtain the supplies of steel needed by them for authorized purposes.

"The rolling programmes at the principal works in the areas are arranged by the Steel Superintendent in consultation with expert Area Committees, composed of representatives of the principal mills. It follows that the Steel Superintendent, who is in constant communication with his colleagues in the other areas, is in a position to give authoritative information in regard to the prospects of obtaining material. To facilitate the regular and frequent rollings of sections, a list of standardised sections has been drawn up and published for information; and if firms confine their requirements for sections to this list there should rarely be any delay in obtaining supplies necessary to enable work to proceed promptly. The needs of the various services and the country generally have been carefully estimated, and the available supplies have been allocated pro rata. In order to ensure that the supplies available do, in fact, go to the destinations allotted, statistical returns are regularly obtained, which give particulars of all manufacturers' deliveries to their various customers. The system of what is known as "Prefix Lettering" for orders has been instituted. These prefix letters indicate the services for which the steel ordered thereunder is to be used, and it has been laid down that no order may be entered or executed unless it bears its appropriate prefix lettering followed by the Admiralty or Ministry of Munitions priority or permit reference, or Government Contract re-

Continued on page 358

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	38.1	50.5
Halifax	39.1	51.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	105 00	105 00
Spelter	11 00	11 00
Lead	10 50	10 00
Antimony	16 50	18 00
Aluminum	50 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 36

	Black	Galvanized
Standard Buttweld		
	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19
Standard Lapweld		
2 in.	29 97	36 45
2½ in.	45 05	55 28
3 in.	58 91	72 29
3½ in.	73 60	91 54
4 in.	87 20	108 45
4½ in.	99 06	123 82
5 in.	115 40	144 30
6 in.	149 80	187 20
7 in.	195 20	243 95
8L in.	205 00	256 25
8 in.	236 20	295 20
9 in.	282 90	353 25
10L in.	262 40	328 00
10 in.	337 80	422 30

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	25 00
No. 1 machine composition	23 00	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	8 00	8 50
Cast borings	10 00	12 00
Stove plate	30 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright	9 50	10 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.	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¾
Grand	19¾	Ideal	17¾
Superior	19¾	X press	16
X L C R	18½		

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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

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AND MANUFACTURING NEWS

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CANADIAN MACHINERY
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September 26, 1918. Volume XX. No. 13

The Making of Milling Machine Dog and Driver

Up-to-date Process in Which a Large Number of Operations Are Involved—Good Methods Used in Locating the Forging

By ROBERT MAWSON, New York

IN this article is described the various operations and tools used when manufacturing a milling machine dog. The practice is largely followed of first machining some important hole and afterwards using this as a locating medium for all subsequent operations.

A quick acting type of jig which is operated with a crank is worth noting, as it is giving good satisfaction in service.

Another milling fixture which utilizes a pin locating into notches on the tool and a previous drilled hole is another interesting tool.

This article deals with the various operations in making what is known as the Kempsmith style.

One of these is shown in the illustration Fig. 1.

By the use of this dog on the milling machine greater accuracy is obtained for such work as gear cutting, machining flutes on reamers, etc.

It will be seen that the tool consists of a driver A and driver arm B.

A ball C is attached to the arm which is a good sliding fit in a groove on the tail of the driver. The action of this ball sliding in the tail between the groove jaws D acts as a universal ball and socket joint.

This removes any tendency to cramp or spring the work since the movable parts of the jaw provide contact without torsional strain.

FIG. 1—A COMPLETE MACHINE DOG.
FIG. 3—DRILLING FOR SET SCREWS.

FIG. 2—BORING AND REAMING DRIVER.
FIG. 4—TAPPING FOR SCREW HOLES.

Boring and Reaming Driver

The first operation on the driver is boring and reaming the groove in the jaws. This operation is shown in Fig. 2.

The forging is placed in the jig with the cover swung back and located against the screw A, being forced against it with the set screw B.

The cover is then swung into position and the screw C tightened onto the forging which not only forces it back but holds it securely in the jig.

A 1 7/64 in. hole is then drilled in the pieces and after the slip bushing has slid along the table so as to bring the hole to be tapped in line with the tap.

It will be seen that the fixture is made with a block A which is placed in such a position that when the forging rests upon it the holes to be tapped are in a horizontal position.

The holding of the piece is a simple operation.

The forging being slid in from the end of the fixture, the handle B forces the block C (by means of the travel of the screw) against the part, thus holding it securely.

forces it down against the lower wall D of the jig.

A hole is then drilled and tapped and the upper part counterbored to suit the binding screw.

The jig is provided with slip bushings so that the various operations may be performed before removing the piece from the jig.

The next operation is drilling the hole for the bottom of the slat and the jig used is shown in Fig. 6.

The forging is again located from the reamed hole in the jaws by means of the

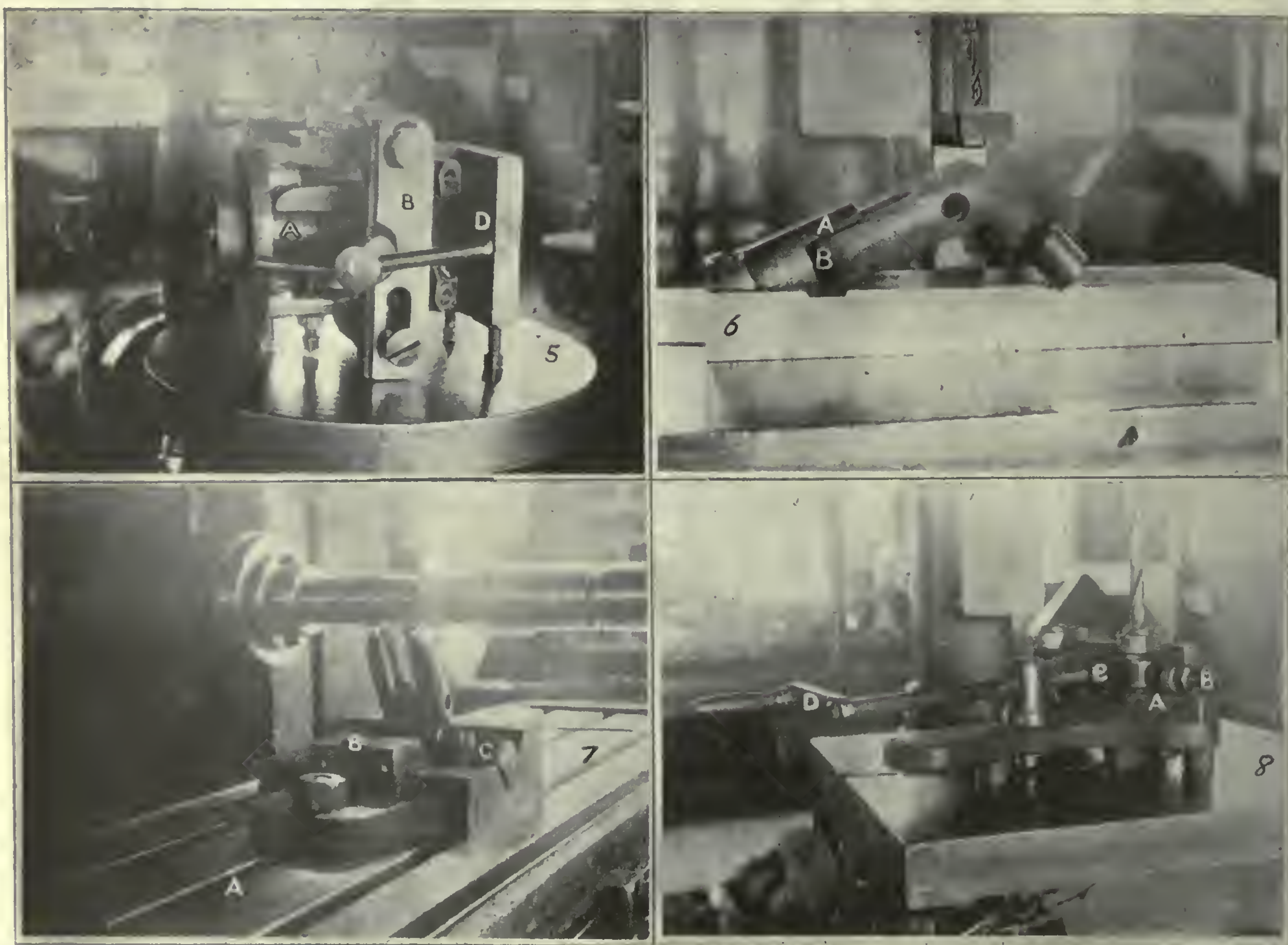


FIG. 5—MACHINING FOR BINDING SCREW.
FIG. 7—SLOTTING THE DRIVER.

FIG. 6—DRILLING HOLE FOR SLOT.
FIG. 8—DRILLING THE CAP.

been changed to suit, the hole is reamed to 1⅛ in., this operation being shown in the illustration. The next operation is milling the vee and facing the joint surface, the forging being held in a vise and a set up of standard cutters being used for the machining operation.

In Fig. 3 is shown the jig used when drilling the set screw holes.

The forging is located by a raised vee block which fits into the surface already machined, the screw A operated by the handle forces back the block B against the forging and holds it securely on the jig. Two holes are then drilled, the tool being guided by bushings as shown.

The holes are next tapped on the fixture shown in Fig. 4.

This tool merely holds the piece and is

Machining for the Binding Screw

The next operation is machining for the binding screw for the jaws.

The purpose of the screw is to adjust the jaws so that the ball will be a good sliding fit, with no play or binding action.

The jig used when drilling for the screw is shown in Fig 5.

The forging is located by the plug A which fits into the reamed hole of the jaws. To place the piece in the jig the strap B is swung back. thus enabling the forging to be dropped into the tool and the plug being slid into the reamed hole of the jaws from the end of the jig accurately locates the part.

The cover is then swung back and the screw C being tightened against the piece

plug A being pushed back against a shoulder at B.

A 7/32 in. hole is then drilled, the tool being guided by means of the bushing in the usual manner.

Slotting the Driver

The next operation is slotting the driver and the method used is shown in Fig. 7.

A rather interesting method of locating the forging is followed in this operation.

The milling cutter or saw which is 3/16 in. thick is set up and the table moved until the cutter is exactly central with the slot A.

The fixture is fastened down to the machine, being located by means of

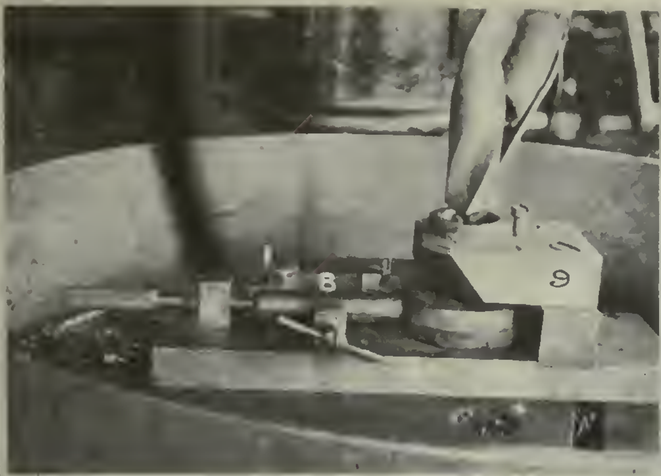


FIG. 11—DRILLING CENTRE FOR SHANK.

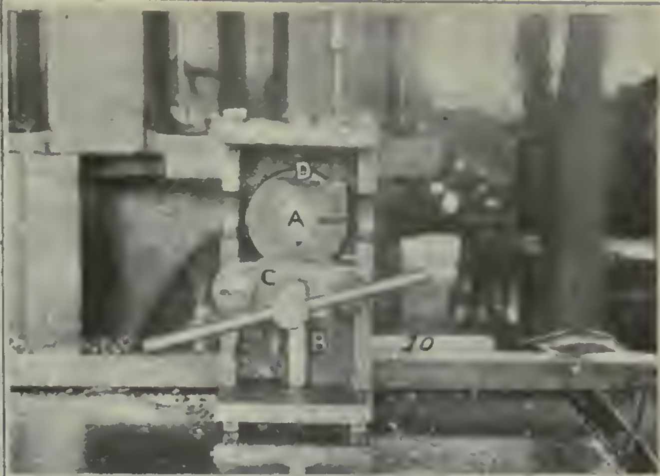


FIG. 12—MILLING SLOTS.

tongues in the usual manner.

A 7/32 in. wire is then placed through the hole of one of the forgings—this it will be remembered is the size of the hole drilled in the previous operation—and the wire is placed in vee B, one in front and the other at the rear of the fixture.

The forging is then fastened down with two straps as C and the wire removed.

The revolving saw is then passed through the forging and the slot is exactly in line with the previously drilled hole. This method is simple yet accurate in results and after the fixture is once set produces duplicate parts. When machining the cap for the driver the first operation is milling the vee and facing and is performed in a manner similar to that described for the driver. The next operation is drilling and counterboring and the jig used is shown in Fig. 8. The forging is placed on two blocks A one on each side so that the vee of the forging does not foul with the jig.

The forging is located against a set screw at the rear of the jig, being forced against it with the set screw B.

The block C being screwed against the forging with the handle D forces back the piece and holds it securely in the jig.

Two holes are then drilled, the body size of the set screws.

These holes are then spot faced to suit the head of the set screws.

Drilling Driver Arm

The first operation when machining the driver arm is drilling and reaming the centre hole.

For this operation the forging is placed in the jig Fig. 9, being located by the blocks A and B, being forced against them with the screws shown.

The large hole is then drilled, afterwards being reamed to size.

In Fig. 10 is shown the jig used for the next operation which is drilling for the set screw.

The forging is placed on the pin A and located in a vee block B with the latch C swung back.

After the forging is in position the latch is swung over and the pin headed set screw being tightened against the piece holds it in position.

The set screw hole is then drilled, redrilled for body size, counterbored and the lower part of the hole tapped, slip bushings being provided for the various sub-operations.

The forging is also drilled and countersunk at D for a centre, the jig being provided with a bushing for the purpose.

The jig is then reversed as shown in Fig. 11 and the end of the forging drilled, tapped and countersunk for turning for a centre which is used in the next operation.

It will be noticed that a bushing A is provided so that the centre will be in the correct location in reference to the shank.

The shank of the forging is next turned to 0.5725 in. diameter, the operation being a simple lathe job. A keyway is next cut in the large hole and needs no explanation. The forging is next slotted for the binding screw and the fixture used is shown in Fig. 12.

It will be seen that this tool is designed to hold 13 forgings at once and they are located by means of the pin A which is made a sliding fit in the centre reamed hole.

The shanks of the forgings rest on the bar B as illustrated.

The screw C is then tightened against the nest of forgings and forcing them back against the rear wall of the fixture holds them securely.

The fixture is located and held to the milling machine in the usual manner.

A 5/32 in. slot is then milled in the forgings as illustrated.

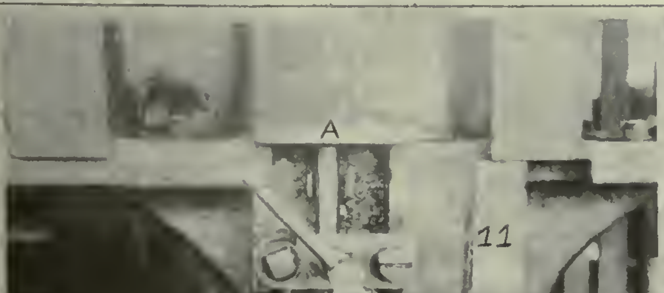


FIG. 9—DRILLING LARGE HOLE.

FIG. 10—DRILLING SET SCREW.

The sides of the forging are next ground so that they are square with the centre hole. The forgings of both elements are polished all over at this stage until a smooth appearance is obtained.

Heat Treating the Forging

The forgings, both driver and driver arm, are then taken to the heat treating department and are first hardened at 1650 deg. Fahr. and then quenched in oil. They are then given their second hardening, being heated to approximately 1,350 deg. Fahr., dipped in a cyanide bath, then given a quick quench in water and finally cooled off in oil. This second hardening produces the mottled effect on the parts.

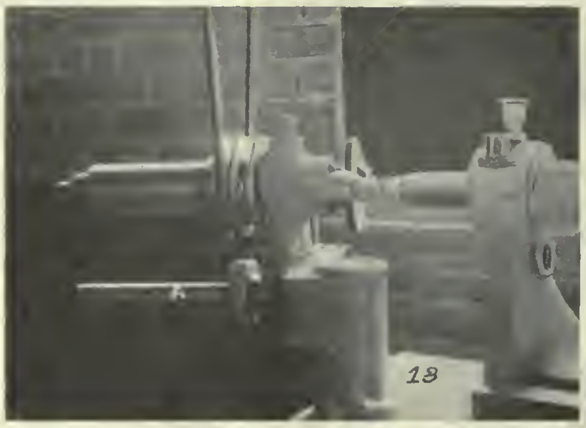


FIG. 13

The shanks of the driver arm are then ground to 0.5625 in. as the next operation. The operations when making the ball for the shank are as follows:—

Drill, ream, counterbore, form and cut off in screw machine. The ball is next hardened for the next operation.

The inside hole is then ground to size as a following operation.

The special machine used when grinding the outside of the ball is shown in Fig. 13.

The piece is placed on a pin which fits snugly the reamed hole. The grinding wheel is then oscillated around the revolving ball by means of the handle A.

The method of driving the grinding wheel can be observed by referring to the illustration.

The table carrying the ball is gradually fed against the rotating grinding wheel which is oscillated until the ball is perfect in contour and exactly 1⅛ in. in diameter. The ball is then attached to the shank of the driver arm and lapped into the driver jaws so that it will work smoothly at every point.

The various parts are now ready to be assembled—driver and its cap with driver arm and ball complete with screw when they are placed into stock ready for service.

DRY AND WET COAL

The effect upon the efficiency of a boiler when using wet and dry coal has not been definitely known, according to J. J. Light, instructor in mechanical engineering, in Bulletin No. 22 of the Engineering Experiment Station of the Pennsylvania State College. Among coal users, especially those operating house-heating boilers, there is a wide difference of opinion as to the relative merits of the practice of wetting the coal before firing. The object of a series of 10 tests tabulated was to show the efficiency of a house-heating plant when fired with coal that has been made wet, and with coal as usually found in cellars of residences, which can be considered as practically dry.

Since two series of tests were run under the same conditions except for moisture of the coal, it is possible to obtain information as to the benefits derived in house heating by firing either dry or wet coal. The conclusion is that the common inference that an addition of water to the coal as fired is beneficial to the operation of the furnace seems false.

The tests from which the results were obtained were in charge of an experienced fireman, who had very strong convictions, from his practical experience, that moistening the coal was a decided commercial advantage in the operation of boiler plants, which fact would in all probability produce an error in favor of wet coal provided any error was introduced.

The item, equivalent evaporation from and at 212 deg. Fahr. per pound of combustible, and the item, efficiency of the furnace, are two factors which would appear to decide the relative merits of the wet and dry coal. It developed throughout the tests that one pound of combustible evaporates more when the coal is fired dry or as is ordinarily found in cellars of residences than when it is purposely moistened. The efficiency of the furnace throughout the tests showed that wet coal tends to decrease rather than increase operating economy.

From a theoretical point of view the addition of water to the coal is a decided loss and would probably be equal to the heat required to evaporate the water added, from the room temperature into steam at a temperature corresponding to the flue gas under the pressure as maintained in the flue. It is the opinion of those who are believers in moistening the coal that the addition of water aids in the complete combustion of the volatile hydrocarbons. This fact probably cannot be disputed, but the tests showed that the gain due to complete combustion is less than the heat carried away by the water. The small differences in efficiencies would, however, hardly be noticeable to most people, and it is quite natural to think that wet coal would give the best results for the reason that coal being wet when placed upon the fire produces slower combustion. This would give better conditions for the combustion of the volatile and other hydrocarbons, but the tests seem to indicate as well as theory that the heat required to burn the wet coal is greater than the heat lost by firing the dry coal.

METHOD FOR THE COMBUSTION OF BROWN COAL

By M. M.

Mr. E. H. Miller has introduced a process for the economical combustion of inferior qualities of coal in boiler furnaces, which gives a greater thermal return than when such coals are burned in air in the usual way. The principle of the process is to apply the conditions that exist in the water gas producer to the boiler furnace, and use exhaust steam for gas production. To accomplish this the producer forms part of the boiler setting, and is placed immediately under the present fire grate area. The ash pit and grate are dispensed with, and in their place is a chamber which is used for the combustion of the gas. By means of this chamber, which is situated immediately under the tubes in the tubular boiler, complete combustion of the coal is assured. The use of exhaust steam obtained from auxiliaries for gas generation permits of the latent heat of the steam being made available which represents nearly five-sixths of the original heat used to form the steam. The water gas, when generated, is at high temperature, and is mixed with air pre-heated by passing through the flues, and ignited. As the combustion takes place almost immediately, after the gas is generated, conditions are such that permit of obtaining a high percentage of the thermal contents of the fuel as effective heat for evaporation.

Experiments have been made using Morwell brown coal, containing over 20 per cent of water, and excellent results have been obtained. Complete control of the combustion is possible, the combustion being absolutely smoke-less. Morwell brown coal lends itself particularly to the preparation of water gas, the high percentage of the water in the coal being in no way detrimental to the formation of the gas. Such coal, when burnt in chain grate or under feed stokers, usually begins to burn when about to be discharged to the ashpit, the high percentage of water having lowered the temperature of the combustion zone long before combustion is complete. The advantage of generating water gas instead of producer gas (carbon monoxide) is that about twice the quantity of coal can be gasified on the same grate area when making water gas than when making producer gas; also advantage can be of the latent heat exhaust steam.

Tantiron; An Acid Resisting Ferro-Silicon Alloy

Acid-resisting Irons of Great Use in Industry—Replace Far More Expensive Metals and Give Equal or Better Service

THE manufacturing chemist and metallurgist are greatly restricted by the limitations of applicability of their apparatus. In many processes, the difficulty is not so much to obtain the raw materials as to find furnaces, containers, pipes, &c., that will bear the chemical and physical stress of the reactions, and to avoid the contamination of the products by the substances with which the reactions bring them into contact. For these reasons many a promising process never gets beyond the laboratory stage; hence, also the cry for substitutes of rare, expensive materials, as well as the natural distrust of them. The enhanced activity of certain chemical industries has much increased the demand for refractory materials and acid-resisting alloys. Experiments with acid-resisting iron alloys are not new, of course. Wollaston made a silicon-iron, and he may not have been the first. Engineers and electricians found silicon-iron very useful for special purposes, and many attempts were made to construct chemical plant of silicon-iron and other iron alloys. Tungsten, chromium and nickel were tried. But foundrymen seemed to be unable to make vessels even of moderate dimensions of such materials, and it was not till 1912 that an acid-resisting iron alloy of sufficient uniformity and strength for the engineer to deal with was put on the market, states "Engineering."

It was the tantiron of Mr. R. N. Lennox, made by the Lennox Foundry Company, of Glenville Grove, New Cross, S. E. Since then silicon-iron and other noncorrosive iron alloys have been brought out by several firms. Both the "duriron" of the Duriron Castings Company, of Drayton, Ohio, and the "ironac," of the

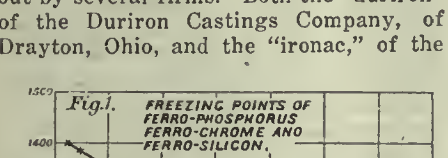


FIG. 1

Houghton Company, of London, are silicon-irons, like the métillures of A. Jouve, one of the first in this field, and the Italian eleanites, which contain about 2 per cent. of nickel. The American rights for tantiron were, in 1913, taken over by the Bethlehem Foundry and Machine Company, Pennsylvania. "Ferrochrome" is supplied by the Electrometallurgical Company of Niagara Falls; the "feralun" is likewise an American product,

FIG. 2

and German activity in the field will not have ceased during the war; in addition to "neutraleisen" there are ferrochromes and ferro borons.

That Mr. Robert N. Lennox should have taken up the manufacture of apparatus for the concentration of strong acids was only natural. His father had made sulphuric acid in Glasgow in the days when heavy investments in platinum plant were indispensable for that purpose. When Mr. Lennox started a foundry on his own account, he had for a good many years conducted experimental engineering works of his own, and had, as assistant in the Royal Institution for nearly 25 years, taken his share in Sir James Dewar's low-temperature and high-pressure researches and in the manifold other investigations which are being carried on in the Royal Institution. Extensive well-equipped laboratories are a noteworthy feature of his works.

Properties

Tantiron—a fancy name—is a silicon-iron, containing about 15 per cent. of silicon. In appearance it is a silvery-white close-grained cast-iron, and has the general properties of a machinable cast-iron. One special brand of tantiron is very hard, and not machinable; another quality resists hydrochloric acid which the others do not. It melts at about 1,200 deg. C., can be cast, ground with carborundum, cut with the saw, drilled, screw-cut and tapped, &c. So far as chemical and mechanical corrosion is concerned, it is a superior iron and is used for cast vessels or in the shape of linings for those of steel or iron. It does not rust, except at the skin, and the rust is removed by pickling in diluted sulphuric acid or by grinding. The tantiron itself is not—or practically not—attacked by sulphuric, nitric, or acetic acids, concentrated or diluted, boiling or cold, and indeed not by most chemicals. One kind already mentioned—a more recent invention—also resists hydrochloric acid equally well. Carbonic acid attacks it slightly, but the corrosion is only about one-thousandth that of cast-iron. Alkalis corrode it about as much as they do cast-iron; chlorates and perchlorates do not corrode it, and it will resist chlorine gas up to a temperature of 105 deg. C. But sulphur dioxide corrodes tantiron badly. In view of this latter fact, the suitability of tantiron pans and basins for the concentration of sulphuric acid is rather surprising Large pans have been in use, however, we are informed, since 1912, and some 25,000 basins are actually in use in sulphuric-acid works. There is some slight corrosion, of course, and there are breakages, partly due to the material, partly to improper treatment by unskilled labour, which causes many small and large accidents in these days of rapid plant erection and high-pressure activity. The maintenance cost of pans and basins is about 2½d. or 3d. per ton of acid concentrated. After boiling 100 grams of the alloy for 17 hours, 10 per cent. sulphuric acid was found to have dissolved 0.13 gram of tantiron, 25 per cent. nitric acid, 0.25 gram, and 30 per cent. hydrochloric acid, .16 gram.

Limitations

The terms "non-corrodible and acid-resisting iron," are misleading, as all such general terms are. Every chemist knows that he must not allow metals to glow in his platinum crucible, as they would form fusible platinum alloys, and that caustic alkalis and certain alkali salts, and even the sooty flame of the gas burner, will ruin his crucible. Tantiron also has its peculiar weaknesses. It resists hot sulphuric acid much better than cold acid, and many instances of attack are so far inexplicable. In one case, a tantiron tower containing vapours from boiling sulphuric acid showed defects in the top sections, without any attacks on the bottom sections. The top sections were replaced several times; the bottom sections, which had

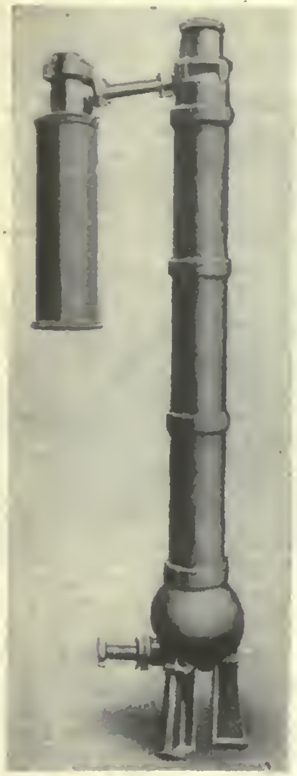


FIG. 3—DENITRATING TOWER

been in use for eighteen months, were taken out and inserted in the top, when they were attacked within a fortnight; yet temperature determinations at different points of the tower never showed differences exceeding 5 deg. C. In other cases, sulphuric acid, on being carefully freed from arsenic by sulphuretted hydrogen, attacked the tantiron nearly three times as quickly as the original acid. But the amount of attack is, of course, exceedingly small. A tantiron vessel weighing 4,950 grams, had 600 tons of sulphuric acid passed through it during concentration with a total loss of weight of 12 gram. The attack is mainly on the surface of the skin, which should, therefore, be removed when corrosion tests are conducted.

Though the iron carbide seems chiefly to be attacked, the corrosion is, apparently, uniform; under the microscope, acid-corroded tantiron keeps its smooth surface, while cast-iron shows irregular corrosion. Mr. Lennox prefers to have no carbon in the iron at all. His raw materials are cast-iron, scrap, and old tantiron, and further ferro-silicon. The latter is obtained with about 12 per cent. silicon from Middlesbrough, and in a 50 per cent. grade from Norway. The average composition of tantiron is in per cent.: silicon, 14 per cent. or 15 per cent.; total, carbon, from 0.20 per cent. to 0.60 per cent.; manganese, 0.25 per cent. to 0.35 per cent.; phosphorus, 0.16 per cent. to 0.20 per cent.; sulphur, under 0.05 per cent. The three kinds mentioned, machinable tantiron, hard tantiron and tantiron for hydrochloric acid, differ little in composition, but the small fractions of additional constituents are very important. To study their influence, ingots are poured from furnace charges of 1 ton, to which additions are made in very small increments; the ingots are then tested chemically and mechanically. The sulphur and manganese, in their percentages, seem to be of no consequence. The phosphorus is deleterious, mainly probably because it is not uniformly distributed, but concentrated in spots. As phosphorus is added to iron, the freezing point is first lowered, and then, when 10 per cent. of phosphorus is exceeded, rises again,, but the cooling curves are not regular, whilst the freezing point curves of silicon-iron and chrome-iron show a very slow, but steady rise with increasing percentages of those elements. (See Fig. 1.) Impact tests are made on ¾-in. square bars, which are not notched; they break, e.g., under stresses of from 8 ft.-lb. to 10 ft.-lb., against 12 ft.-lb. to 14 ft.-lb. in the case of cast-iron. On the whole, the strength of tantiron is about 25 per cent. smaller than that of cast-iron. The following is a summary of the comparative properties of tantiron and cast-iron (the latter figures in brackets): Density 6.8 to 7.0 (7.3); tensile strength, 6 to 7 (9 to 10) tons per sq. in.; transverse strength, bars of 12 in. by 1 in., 1,600 lb. (2,500 lb.); crushing strength per inch cube, 34 (40 tons); melting point, 1,200 (1,150) deg. C.; hardness, 1.6 (1); heat conductivity, 8 (10); electrical resistance,

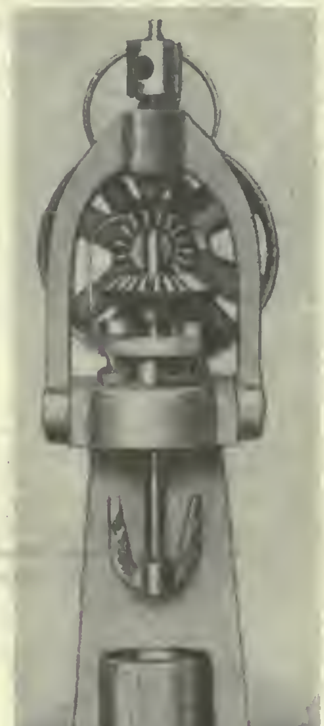


FIG. 4—AUTOCLAVE CUP OPEN ON STAND

10 (8); resistance to corrosion, 1,000 (1); contraction allowance in casting, 3-16 (⅛) in. per ft. As regards other properties, also of other materials, the comparative order for iron, tantiron, lead,

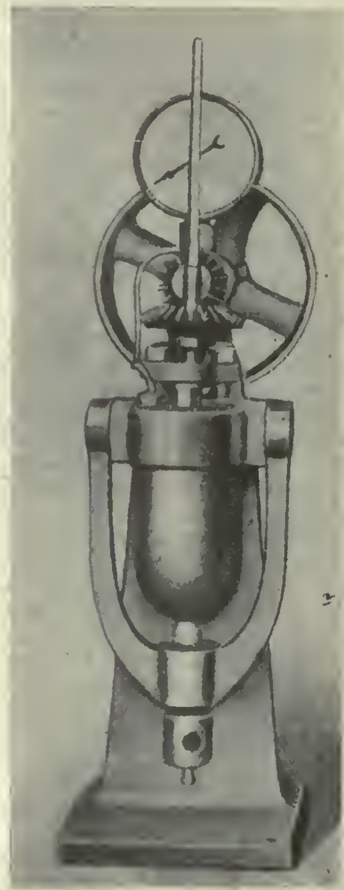


FIG. 5—AUTOCLAVE CUP CLOSED

quartz, stoneware is: Transmission of heat, 230, 215, 115, 28, 20; hardness, 24, 35, 1, 52, 32; density, 7.3, 7, 11.3, 2.6, 2.0; melting point, 1,150, 1,200, 335, 1,900, 1,800 deg. C.

Limits of Corrosion

With respect to corrosion by chemicals, there is generally a first attack, followed by relative immunity under continued exposure. The following figures indicate the percentage losses of tantiron after boiling for 24, 48, 72 hours; the greater action during the first 24 hours is largely due to the already-mentioned skin effect, the outer surface having been changed by contact with the sand in which the tantiron is cast; this skin is removed in the foundry, as we stated.

	First 24 hrs.	Second 24 hrs.	Third 24 hrs.
Sulphuric acid, 98 per cent.	.10	.02	.02
Sulphuric acid, 30 per cent.	.07	.00	.00
Nitric acid, 1.4	.03	.01	.00
Nitric acid, 1.1	.01	.00	.00
Acetic acid, 60 per cent.....	.03	.01	.00
Chromic acid, 10 per cent...	.07	.00	.00
Tartaric acid, 25 per cent...	.05	.03	.03
Iodine (sat. sol.)	.00	.00	.00
Bromine water (sat.)	.01	.01	.00
Bleaching powder (sat. sol.).	.04	.01	.01
Copper sulphate (acid sol.)..	.00	.00	.00
Copper sulphate (alkaline)...	.00	.00	.00
Ferric sulphate (sol.)	.06	.00	.00
Zinc chloride, 30 per cent...	.03	.00	.00
Ammonium chloride sol.	.05	.02	.01
Fused sulphur	.06	.01	.00
Fused nitrate of ammonia ...	.00	.	.00

To meet the peculiarities of the material, it is desirable that designers of parts to be made in tantiron should bear the following rules in mind: large flat surfaces should be avoided, corners be

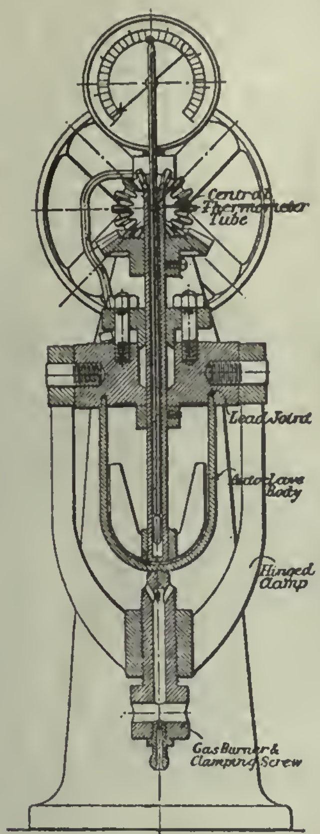


FIG. 6—SECTION THROUGH AUTOCLAVE

rounded; slots be used by preference to bolt holes; facing strips be narrow and of ample height; the effects of expansion and contraction should be well-considered; coring and moulding be made easy, by preference without the use of chaplets to support cores. Among the chief products now made wholly or partly of tantiron, are: acid pans, basins, stills, bleachers, denitrating towers, autoclaves, condensers, pumps, stop cocks, valves, pipes and fittings, electrodes, &c. Frequently a tantiron lining will suffice to prevent either chemical or mechanical erosion. The largest tantiron casting so far constructed weighed 7½ tons.

Moulding

The greatest care is bestowed upon clean moulding, which is mostly done by women, and use is made of rotating strickles in preparing the moulds for parts of circular section. For lining pipes with tantiron, the pipe must be suspended vertically by a flange with the core in proper position, the pipe to be lined being weighted below; if the liquid tantiron were poured into a horizontal pipe, the pipe would curve. This practice is generally adopted for lining iron or steel, wherever possible, and the part to be lined is well dried, but not pre-heated. The adhesion between the iron and the tantiron is said to be good, fusion taking place between the surfaces; the adhesion is tested with the aid of paraffin oil. The lining may have a thickness from ¼ in. up to 1¼ in. and more. The subsequent finishing of the product is largely done with the aid of carborundum wheels and grinders. It is rather curious that the fine tantiron particles torn off by the tools do not spark; there is only a glow. Drills, saws and planers are also used.

The basins for the heating and concentration of sulphuric are mostly of the plain porcelain dish style, but are provided both with a lip and an arc-shaped baffle (not shown); they are supplied also in the Webb and Dyson styles (Fig. 2). The basins are arranged in cascade, so that the hot acid drips from the lips of one basin into the one next below, and the baffle prevents the acid from streaming right over the basins to the lip. Provision for more efficient circulation and stirring of the acid in the basin is made in the "Mackenzie field tube evaporator basins," also supplied by Mr. Lennox; this style has calix shape, being a tube opening out into a basin; a "field" tube fits concentrically into the cylindrical portion and promotes active circulation. Other basins are provided with covers and necks, and made corrugated, and they serve generally also for the concentration of corrosive liquids, such as zinc chloride, lead nitrate, &c.

Concentration of Nitric Acid

The concentration of nitric acid requires more varied apparatus, which have successfully been made of stoneware in the past few decades. When the war broke out, the stoneware works of this country were not able to deal with the demands, and tantiron vessels, which can be made in a few days, whilst good stoneware requires months, were largely adopted. Valentiner plants, comprising a still, condenser and coils, built up of pipes and return bends flanged together, all of tantiron, are now made. The denitrating tower illustrated in Fig. 3 is an interesting novelty. The spent acid of nitroglycerin works consists of diluted sulphuric acid, which has to be concentrated again, and some nitric acid, which is to be regained by distillation. There may also be small globules of oily nitroglycerin which might coalesce if the evaporation were carried on in pans. The tower, 15 ft. high, is built up of socket pipes, 14 in. diameter, and is packed with quartz fragments; the acid enters at the top and steam at the bottom, and the nitric acid and vapours condense in the cylinder by the side of the tower. Nitric-acid stills are also used for the distillation of acetic acid. The autoclaves for making ammonium nitrate from cyanamide at a temperature of 120 deg. C. and a pressure of about 2 atmospheres, resemble one

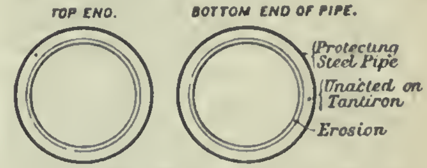


FIG. 7—EROSION OF TANTIRON PIPES IN SERVICE

style of nitric-acid retorts. The outer vessel is a jacket of cast iron, the inner vessel of tantiron forms the saturator; the height is 8½ ft., and the diameter 4½ ft., e.g.

The autoclave illustrated in Figs. 4, 5 and 6 is a clever compact laboratory apparatus, whose utility and handiness will appeal to every chemist. The ordinary autoclave has to be screwed up tightly and unscrewed again each time. In this Lennox autoclave the parts are clamped and unclamped by the use of one spanner, and everything, crucible or cup, stirrer, pressure gauge, burner, is ready for use. In Fig. 4, the cup is seen on its stand open, and the stirrup clamp is turned up. When the cup of tantiron is lifted, and the clamp turned down, the cup is pressed against the lead joint in the cover (Figs. 5 and 6), and the autoclave is sealed; the bolt passing through the clamp, by means of which the autoclave is tightened up, also serves as the gas burner, and the axial stem of the stirrer is hollow to receive a thermometer; the stirrer is actuated by an electric motor.

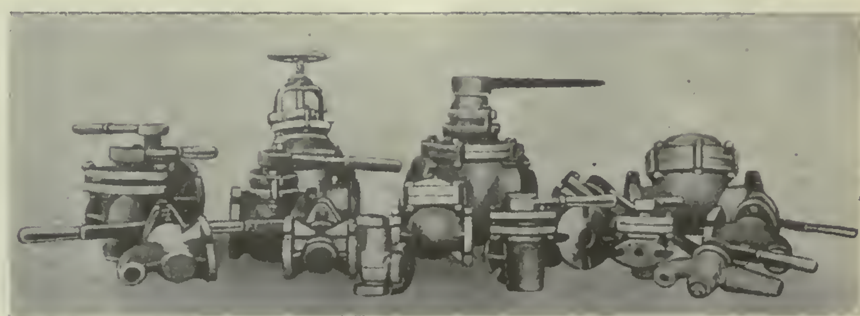


FIG. 8—ACID PROOF VALVES AND FITTINGS

Acid eggs, apparatus for forcing up corrosive liquids with the aid of compressed air, are made of two tantiron cups, joined by their top flanges so as to form a horisontal cylinder with spherical ends and one common flange on the vertical middle plane; they are provided with acid inlet and outlet valves and an air pipe, and are supplied in large sizes. The pumps of the works, reciprocating and centrifugal, do not differ much in appearance from ordinary pumps; the barrels and impellers and pipes are made of tantiron or lined with it. As these parts of hard tantiron cannot be machined or repaired, it is recommended to keep spare parts ready for cases of accident. Centrifugal pumps are supplied for lifting 6,000 gals. of acid or corrosive mine water, &c., per hour, against a head of 50 ft., running at 1,600 r.p.m. Slime pumps, e.g., for conveying the crushed quartz in gold mines, are likewise made of tantiron, to obviate the heavy erosion of the pipes by the gritty quartz particles. For the same reason, tantiron-lined steel pipes are used in the Rand mines, South Africa, for the sand-filling plant When the pillars left in the galleries below are to be removed, the galleries have to be refilled with the finely crushed quartz from the vast white waste mounds which form a conspicuous feature of the district. The spoil is flushed down the pipes with water. The first pipes used, steel pipes, were ruined by 6,000 tons of sand; porcelain-lined pipes were then tried, which could stand up to 50,000 tons; the tantiron pipes, introduced four years ago, are still doing duty, and their life capacity is estimated at 500,000 tons. The 500 ft. of 5-in. pipes put in were delivered in sections of 7 ft. Fig. 7 illustrates the erosion they had undergone by the passage of 106,000 tons of quartz sand under a head of 500 ft. In each case the outer ring represents the steel pipe, the second, intermediate ring, the tantiron remaining intact, and the inner ring the eroded thickness. The erosion is greater at the top, where the sand strikes the pipe than at the bottom, and is not the same in all sections, probably owing to peculiarities of their positions. Similarly-lined steel pipes and tantiron pipes, up to 2 ft. in diam., are in use for ash ejectors, especially on board ship, where heavy erosion and corrosion by the caustic ashes and the sea water have to be guarded against.

In stop cocks and valves of tantiron corrosion by acid sodium bisulphate (the acid cake residue of the distillation of nitric acid from salt and sulphuric acid), erosion by grit, rusting and sticking are the chief sources of trouble to be met. Here, again, tantiron competes with lead and stoneware, and its advantages lie in greater strength and indifference to high temperatures and frost. Fig. 8 shows types of cocks up to 4 in. in internal diam.; a groove is made in the centre of the cock and charged with a greasy preparation of ceresin, vaseline, black lead, and asbestos, which is pressed into the groove by means of a screw. A great variety of cocks, valves, T-pieces, straight and bent socketed pipes, provided with threads, are made in tantiron.

Specialties

Of other specialties, we mention the corrosive-vapour drying and baking ovens, the flat doors and walls of which are lined with sheets of tantiron, which are screwed on. Tantiron can be rolled at about 700 deg. C., but is brittle then. Another specialty is the tantiron electrode for cyanide baths (silver and gold), and also copper baths, &c., replacing iron and other alloy electrodes, which are not insoluble, and very objectionable on this account, or more expensive than tantiron. For the same reason, steel-mixing mills for the manufacture of manganates, the balls and stirrers of other mills, and many apparatus used in the acid and dye and other chemical industries, are made of tantiron.

Foundry work had been carried on in the buildings which Mr. Lennox now occupies for over 100 years. There are 2½ acres under roof, and about 200 people, including 50 women, are now employed. The work of the women, who have all been trained at the works, gives complete satisfaction; excepting in the pouring department, in which men alone are employed, they work in all the departments, in the laboratories, moulding pits and machine shops, as well as in the office, but are under the special control of a lady on the staff, who also looks after their little privileges as to tea and rest intervals, their starting work 10 minutes after the men, and leaving before them, &c. When husband and wife are both in the works, they are not attached to the same department.

Like every manufactured article, tantiron is constantly being improved, and does not claim to have reached final perfection. Acid-resisting materials must possess various properties which are not easily combined, and possibly not capable of combination. A compromise has to be accepted.

ARGENTINE NAVIGATION—ITS ORIGIN AND GROWTH

By R. E.

It used to be a common saying in Australia that New Zealand and the "Union Line" meant pretty much the same thing—the country and the company were so closely interwoven that the one was regarded as the complement of the other, and much the same thing may be said, with certain differences, of Argentine and the Argentine Navigation Company, for along 3,000 miles of river Argentina may be said, without exaggeration, to have its origin in Nicholas Michanovitch, for until he appeared on the scene the river transport of the river and immense territories of Argentina was infinitesimal and of deep sea transport she had none.

It was in 1864 that Nicholas Michanovitch, then a youth of seventeen landed at Monte Video, without friends, without money, and unable to speak the Spanish tongue. The war with Paraguay soon began, and young Michanovitch, taking "anything that offered." obtained employment on store ships, in a comparatively short space of time becoming master of a small coaster at Buenos Aires. Then followed, in 1875, the hiring of a couple of tugs, and the opening of a combined office and store—a single room—and on these small, but, as they proved, secure foundations, Nicholas Michanovitch began to build. The tugs, which at first, he was able to hire, he soon became able to buy, and, as time went on, to add to their number, and when we remember that at Buenos Aires in those days there was no "tying up" ships having to lie out in the river and discharge into lighters, it followed that, with the trade of the port steadily increasing, lighters and tugs became in still greater demand, and the man who could supply them prospered correspondingly. Michanovitch gradually extended his activities, placed an order in England for a cargo steamer, and this vessel was the first of her class to enter the port of Buenos Aires, as it then was—in 1880. An opposition tug and lighterage company was then bought out by Michanovitch, who, by 1889, owned over 30 tugs and lighters, and, by the end of 1889 was the possessor of a fleet of over 100 vessels, and now the rapidly developing trade of Buenos Aires and the Plate ports carried with it a corresponding increase in the, by this time, extensive business of which Michanovitch was the master-mind. Year by year business expanded, and in 1909 Michanovitch formed the Argentine Navigation Company (Nicholas Michanovitch, Limited) which, on the outbreak of the present war, owned a fleet of over 300 vessels, and was described by the Chairman at the R.M.S.P. meeting, in language by no means overdrawn, as "an important concern, with an extensive organization for linking up the South American ports by means of vessels, river craft, tugs, lighters, etc."

From the beginning the Argentine Navigation Company prospered exceedingly. An extract from the chairman's report of December, 1910, reads: "Argentine has over three thousand miles of river available for navigation, and nearly two thousand miles of sea coast. On all this vast extent of waterway the fleet of this company is constantly plying, serving the ports, the townships, and the settlements. Our service across the estuary of the River Plate between the capitals of Argentine and Uruguay, is of invaluable public utility by connecting those two countries. The steamers undertaking these nightly runs are handsome modern boats, equipped with all that can be desired for the comfort of passengers. Another service of upwards of one thousand miles unites Argentine with Paraguay, giving a fast service between the two capitals. Even beyond Asuncion the service continues to the distant town of Concepcion (as far north, almost, as the latitude of Rio), and, at the same time combines a service on the Alto Parana. Fifty ports and townships are in this manner linked up with the metropolis of Buenos Aires and put in touch with Europe. Still another service navigates the waters of the Uruguay to meet the requirements on both the Argentine side and that of the neighbouring republic."

The "War Taurus" Takes the Water at Polson's

Steel Vessel Being Turned Out to the Order of the Imperial Munitions Board—Launching Was a Complete Success in Every Way—Work Held Up For Some Time by Strike

A FURTHER useful contribution to Canada's war effort was made on Thursday, September 19th, when the steel steamer "War Taurus" was successfully launched from the yards of the Polson Iron Works, Toronto. The launch passed off without the slightest sign of a hitch to mar the event, the vessel starting to move with the firing of the gun, and being moored at her berth almost before the disturbance incidental to her striking the water had died away. The "War Taurus" is one of six similar vessels which are being built for the Imperial Munitions Board. The work of building the vessel has been greatly hindered by a strike of the marine steam fitters and helpers, and it has been necessary to launch her without fitting the sea connections, which will cause further delay in the completion of the hull, ready for sea. The strike was occasioned by the refusal of the company to recognize the steam fitters' union and run a closed shop, which the company has never done in its thirty-five years' existence. Without discussing here the merits of the case it is certainly a lamentable state of affairs that when ships are so badly needed the building should be held up for weeks by labor troubles.

THE LAUNCH OF THE "WAR TAURUS"

The "War Taurus" is a steel vessel of 261 feet in length by forty-three feet six inches beam, and a moulded depth of twenty-three feet. She has been constructed under the classification of the British Corporation and her propelling machinery consists of triple expansion reciprocating engines, the cylinder dimensions being H.P. 20½ inches dia. I.P. 33 in. and L.P. 54 in. with a stroke of 36 capable of developing 1,250 horsepower. She has two boilers of the Scotch marine type, 14 feet diameter by 12 feet long, working at 180 lbs. gauge pressure.

Haste Not Everything

Discussing the shipbuilding situation with Mr. Frank E. Wall, the works manager and chief engineer of the Polson Company, the subject of making records in ship building was brought up. Mr. Wall pointed out that building and completing a vessel in the shortest possible number of days was not so desirable an accomplishment as the general public might be led to believe. He pointed out that many of these ships, after a short trial trip, had to be re-docked and considerable time spent on them, before they could undertake a long voyage, but this phase was never referred to in the published reports of the records achieved. He held it was more desirable to take a reasonable length of time for the building and completion of the ship, so that when she was completed she was ready to start on a voyage of any duration without the necessity of dry docking.

There are several more vessels on the stocks in the Polson Company's yard, and it is hoped to launch three more during the early days of October. It is interesting to know, in this connection, that with the exception of some of the auxiliary machinery practically everything else is built from the raw material in the company's shops.

STRINGERLESS SHIPS

By R. C.

Until quite recent times it was considered absolutely essential to the stiffening of the side plating of a ship that longitudinal side stringers should be fitted between the bilge brackets and the beam knees, this being in accordance with Lloyd's rules. Many vessels are now, however, being built without side stringers, compensation being provided by slightly increasing the depth of the beam knees, these modifications being sufficient to satisfy the rules issued by the classification societies. Many advantages follow the elimination of the side stringers. In the first place there is a considerable saving in the cost of construction of the vessel; moreover, there is additional cargo space, and the ship is very convenient to discharge, there being no shelves for the lodgment of such cargoes as grain or coal. Further, the increased depth of the bilge brackets either avoids or reduces the unsupported span of the frame between the bilge brackets and the beam knees, which admits of a reduction in the size of frame so that it is possible to utilize bulb angle frames instead of the built sections provided for by the rules. It is open to question, however, whether it is structurally safe to dispense entirely with side stringers, although the fact that many builders are at least convinced of the advantage which result from this method of construction.

THE "WAR TAURUS" ON THE WAYS

We Want 100 Editors

CANADIAN MACHINERY wants its readers to help edit this paper. There are men in the tool room, in the machine shop, in the pattern room, at the drafting board, in the sales department—all over, in fact, who are good editors. We want them to work for us.

A good editor is a man who can get his ideas over to the other fellow.

CANADIAN MACHINERY wants articles on shop practice, new devices, new ideas. We want stories of how repair jobs have been done, how production has been increased, how you have been helped in your work.

We want anything that has shop atmosphere in it. The man out of the shop cannot be as good an editor for a mechanical paper as the man in the shop. We want an editorial staff that will stretch right across the Dominion.

If you have never written for publication, try it. Your work will be given the fairest treatment here. If you have sketches illustrating your idea, send them along. If they are worked up properly, all right. If they are not, our own draftsmen will attend to this for you.

CANADIAN MACHINERY pays for this work. Some mechanics are making a nice little side line out of this. Besides this, it gives you an added confidence in your work, a new pride in your trade, and it will bring out the ideas of some other fellow who may have worked the same problem in an entirely different way.

In these days of special work on munitions there are numerous ideas that ought to be passed along. Don't take it for granted that all other mechanics have had the same experience as you have passed through. Your ideas may help some person to be a better mechanic.

Address your copy and drawings to Editor, Canadian Machinery, 143 University Avenue, Toronto.

IS THE TRAINING WORTH THE TIME AND MONEY PUT INTO IT?

To the Editor, Canadian Machinery: My attention was attracted recently to a large poster asking for men for munition works, the wages offered being from $4 to $15 per day. As I understood that the days of fabulous wages for the work of sticking shells into an automatic machine had gone by I naturally wondered what particular operation could command $15 per day, and how many of those $15 jobs were vacant. Evidently, if men to fill them had to be procured by display advertising on the hoardings there must be quite a few of them, for generally speaking the men who can command salaries at the rate of $4,500 per annum are not studying the bill boards to find a vacancy. It would seem that these very desirable rates must still be going to the men engaged in the mechanical work, and this occasioned some thought as to the rewards to be gained by the professional man as against the working man.

When we find conditions such that a comparatively unskilled laboring man earns from $4 to $5 a day, and skilled men from $5 to $15 per day, we would naturally think that the men in the higher engineering positions, who must be technically trained as well as practical experienced men, would be drawing salaries in proportion. However, this does not seem to be the case, for the average salary paid to the skilled engineer in the drawing office is not to be compared with the wages paid for instance to a toolmaker. I remember the case of an engineer, and a very clever one, engaged on the design and layout of a large munition plant, who was receiving less than $200 per month, and when the plant was started up alien enemies were drawing $12 and $15 for 10 hours work on shells.

This may be a question of supply and demand, but one is forced to wonder if the time and money spent on training an engineer is in the majority of cases worth the while. Hoping to hear from some of your readers on this question.

Yours truly,
MECHANICAL ENGINEER.

ARE THE SHOPS UNWILLING TO RECEIVE SUGGESTIONS FROM MEN?

Toronto, Sept. 23, 1918.

Editor CANADIAN MACHINERY:—

Sir,—Re your article, "The Foremen That Are Wanted."

Your article opens up a controversy in which most mechanics will bear me out when I say that there are lots of thoroughly good men in the machine shops of this and other cities of Canada who are great readers of the CANADIAN MACHINERY and the allied papers connected with the machinist business.

These same men are also able to instruct how a certain job may be done to the best advantage and in the minimum of time, compared with the methods at present in existence in some of the large shops, where there is a lack of tools and also where jigs could be made for the speedy output of certain operations.

I have in mind one munition firm where I was employed for a period of nearly 12 months and where I was in charge of the machine shop for the greater part of the time. I suggested more than half a dozen different operations, where, had they employed jigs for the production of parts, half the time could have been saved with a great saving of expenses, not to mention the time wasted by the operators hanging around waiting for tools, etc. The outcome of which was, I was politely told, I was to do as the heads higher up said. This is the one chief fault in the shops now-a-days. Needless to say, I got out. I think sometimes that it is a mystery to lots of good mechanics how on earth some firms pay their way at all and make money.

I have now a position with a large corporation where, for system, there is absolutely none in the place whatever. Take, for instance, their class of work. With the addition of one or two machines of the automatic type the output

(Continued on page 370.)

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

METAL SAWING MACHINE

THE cold saw illustrated has been manufactured by the Swind Machinery Co. of Philadelphia to fill the need for an inexpensive yet efficient and practical cutting machine.

The frame is a substantially rectangular housing provided with adjustable clamps, with movable jaws at opposite sides for supporting work or bars to be cut.

The oscillating cylindrical carrier contained in the frame is provided with an eccentrically mounted saw spindle carrying a circular saw. The carrier is rotated through the medium of a circular rack and pinion which automatically feeds the saw into operative engagement with the work.

The drive is of the single clutch pulley type operating the drive shaft and extending longitudinally through the machine frame. The drive shaft is properly journaled at the forward and rear walls of the frame and is secured by end thrust collars.

The automatic feed comprises a stationary rack bar, carried by the frame, a pinion shaft journaled in the carrier, with ratchet wheel on the opposite end, actuated by a bell crank lever, pivoted to the rear end wall of the carrier and eccentrically connected by means of link, which is fixed on the rear end of the saw spindle shaft. A bearing cap at the upper end of the link is transversely slotted, thus permitting suitable feed adjustment, which in turn is actuated by duplex engaging ratchet wheel, thus giving automatic rotation to the carrier.

METAL SAWING MACHINE

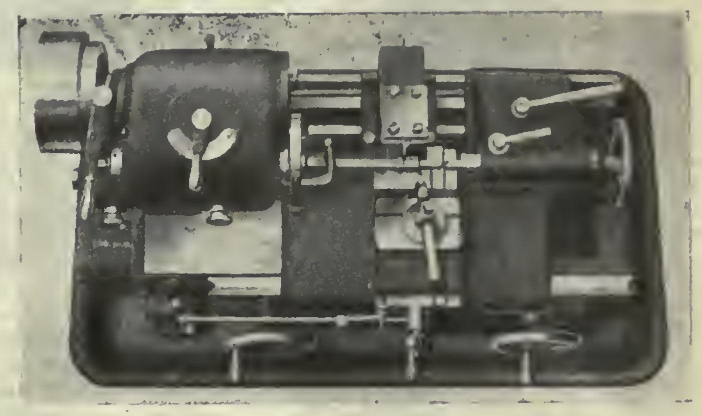
The pump is spur gear connected and located on the inside of the machine frame, thus insuring compactness and freedom from annoying belt troubles. Ample chip space is provided with proper oil drainage and accessible reservoir for the cutting lubricant is contained in frame of machine.

MANUFACTURING LATHE

The Rockford Tool Co., Rockford, Ill., have placed on the market a special lathe to meet the requirements of those engaged in the production of large quantities of duplicate parts. The machine is of simple and rugged design and ample power is provided to enable machinery operations to be performed under the maximum conditions of feed and speed. Since there are a great many lathe jobs performed which consist of machining short pieces of small diameter, a considerable saving in floor space is effected by designing a machine suitable for this work.

The Bed of the Sundstrand Lathe

The bed is of a new design, having separate ways for the tool carriage and the tailstock, the arrangement being such that the carriage can travel to the end of the bed in front of the tailstock. It will be apparent that this allows the tailstock to be set up close to the work, eliminating the overhang of the tailstock centre. The bed is of deep section and ribbed to afford the necessary rigidity. An all-geared type of headstock is employed, which is operated by sensitive friction clutch upon which the driving pulley is mounted. This clutch is manipulated by conveniently located lever and the same movement that disengages the clutch automatically applies a friction brake which stops spindle almost instantly. This permits quick removal of finished pieces and setting up of blanks, and it also permits the spindle to be instantly stopped for measuring the work, etc. The spindle bearings and all the other principal bearings in the headstock are fitted with SKF self-aligning bearings.

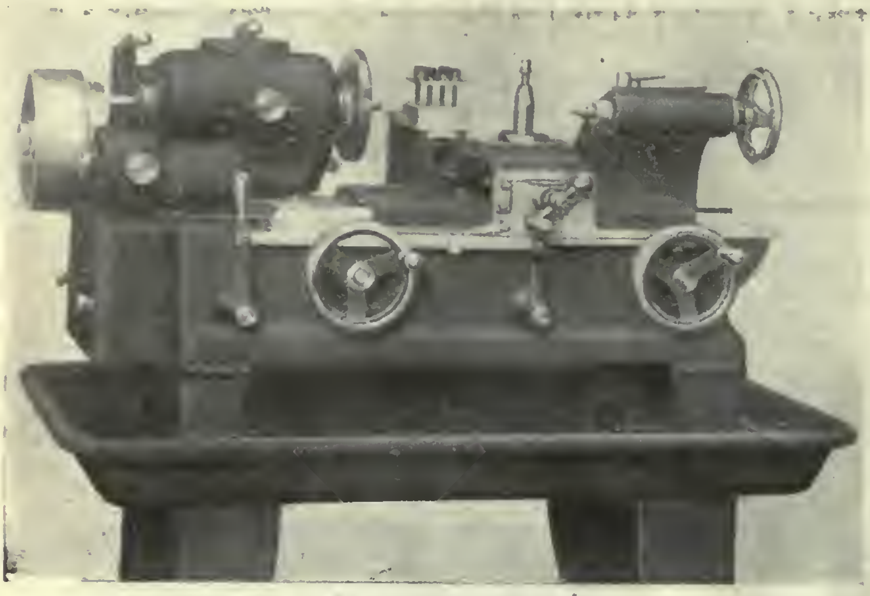


SUNDSTRAND LATHE

Spindle Speed

Three spindle speeds are instantly obtainable by means of a shifting lever, and additional speeds are obtained in series of three by changing two auxiliary gears on the end of the headstock. Four auxiliary gears are furnished by means of which twelve spindle speeds are obtainable. Gears in the headstock run in a bath of oil which assures adequate lubrication. The design of the spindle has been worked out to adapt it for the use of draw-in collets. Movement of the carriage is effected by a screw located between the ways, directly under the tools; this position reduces torsional strains to a minimum. Automatic adjustable stops are provided for the carriage. A special plain rest is furnished as a regular equipment for the carriage. Rear tool-holders of the multiple-tool type for use in the performance of facing and grooving operations, etc., can also be easily mounted on the rear ways where they are entirely independent of the carriage. Cross-feed to the rear tool-holders is operated by a handwheel at the front of the bed and both the front and back tools are equipped with positive stops. A back-rest, taper attachment, draw-in attachment and collets, oil-pump, etc., can be furnished as special equipment whenever required.

The principal dimensions of this lathe are as follows: swing over bed, 9 inches; swing over plain rest, 7 inches; distance between centres, 12 inches; diameter of hole through spindle, 1⅜ inch; maximum collet capacity, 1 inch; diameter of spindle nose, 2⅛ inches; threads per inch on spindle nose, ten; size of cutting tool, ⅝ by 1⅜ inch; length of carriage on bed, 18 inches; diameter of driving pulley, 8½ inches; width of driving belt, 2¾ inches; regular speed of driving pulley, 350 revolutions per minute; number of available speeds, 12; number of available feed changes, 4; floor space occupied by machine, 45 by 24 inches.



MANUFACTURING LATHE

VARIETY SAW

The Variety saw illustrated has been designed for light, accurate work in furniture, cabinet, sash and door factories, or wherever light ripping or cross-cutting is required.

The frame consists of a single box-shaped casting, with a flared base to give ample floor support and that solidity upon which the success of any woodworking machine depends.

The cast-iron table is 40 in. long x 32 in. wide. It is equipped with a removable wooden throat plate 15½"x16" to permit the use of extra thick saws or dado heads. The semi-circular rockers supporting the table permit it to be tipped to any angle not exceeding 45 degrees, while a graduated segment bracket indicates the degree of angle and binds the table firmly in any position.

Fences. The ripping fence is of the double-faced type and can be used on either side of the saw blade. It is supported by a long guide securely bolted to the front of the table and is held in place by a convenient star wheel. A special graduated cut-off fence that can be used on either side of the saw is supplied. This fence slides in grooves cut in the table. The operator can cut off stock with square, bevel or mitre ends, either to simple or compound angles as he desires.

The arbor is of special high-carbon steel 1 7-16 in .in diameter and runs in the best babbitt bearings, accurately scraped and equipped with ample oil reservoirs. These bearings are cast solid to a heavy and well-proportioned yoke that is supported on steel ways attached directly to the main column at such an angle as to assure an equal belt tension regardless of the position of the saw arbor. The arbor is raised and lowered by means of a square thread screw operated by level gears and hand wheel so placed as to be most convenient to the operator. A cone bushing on the end of the arbor permits the use of saws with holes from ⅞ in. to 1½ in. diameter.

The countershaft is placed at a suitable distance from the machine to ensure a long belt pull at the proper driving angle. A ground plan of this machine will be furnished to enable the purchaser to set the countershaft at the proper position.

This machine is manufactured by the Canada Machinery Corporation, Galt.

ARE THE SHOPS UNWILLING

(Continued from page 368)

could be more than doubled from the present, and with a reduction of the staff. There is the same old story here: If you want to be treated right you must not suggest any improvements, or the foreman in charge thinks you are after his job. Still the firms are crying out they can't get good men, when with a little forethought and the introducing of a system they could employ unskilled labor where at the present time they are employing what are generally termed "war mechanics." This is how I have found it to be at the present time and I think there are a favorable number of your readers that will bear me out in my statements.

For myself, I have said that I am far better off as an ordinary workman than being in charge of a number of men, but the old desire gets me after a while, I want to be up and doing.

I omit my name for obvious reason and sign myself

JUSTICE.

ACETIC ACID AND ACETONE FROM CARBIDE IN GERMANY

(Translated for the British Board of Trade Journal.)

One of the results of the war economy in Germany has been the manufacture of acetic acid and acetone from carbide. Acetic acid, the *Norddeutsche Allgemeine Zeitung* writes, was nowhere used for so many purposes as in Germany. A series of synthetic dyes, including artificial indigo, is based on acetic acid, which is also used for important medicinal substances, such as acetate of alumina and acetate of lead, and for innumerable synthetic medicines, such as aspirin, antipyrin, and phenacetin. A number of synthetic scents (e.g., vanillin, sumarin, and ionone, derivatives of acetic acid), which are used for giving an aroma to fruit juice and sweets, are also serviceable as solvents, and for the gelatine process in the manufacture of explosives. The salts of acetic acid serve as indispensable mordants in dyeing and calico printing, and provide an important white for mineral colors. Artificial silk, too, owes much to acetic acid.

It is thus obvious that acetic acid may be put to a variety of uses, and in the last pre-war year its consumption in Germany for technical purposes comprised nearly one-half of the total amount produced, viz., 15,000 tons, as compared with 16,000 tons of ordinary vinegar for human consumption.

VARIETY SAW

Until a few years ago acetic acid was made either by fermenting alcoholic liquors or by distilling acetate of lime ("grey lime," as produced in the wood-distilling works) by means of sulphuric acid. By the first process some 13,000 tons were ob-

(Continued on page 378)

Bill Couldn't Grow With the Old Man Over Him

But He Got His Chance to Develop, and Now That He Has Plenty of Elbow Room and Responsibility, He's Making Good With a Vengeance—He's Got a Title Now That He Likes

WELL, Bill signs himself superintendent now, and he's made good with a vengeance. I don't care how many titles he takes to himself. It's results we're after and if he can get results better with the title of superintendent pinned to him, we haven't the least bit of objection. On the other hand we say, "Go to it Bill."

A Canadian machinery dealer had been telling us about some of his experiences. He isn't a one-shop man. He has seen quite a bit of buying and selling, and knows how the machines are put together from the ground up. And what's more he's doing a lot of business right now in Canada, and unless all signs fail his company is going to continue to do a lot of business in this country both as jobbers and manufacturers and designers.

Well, his story ran along something like this. The conversation had drifted to placing responsibility on men, and developing them in that way. It was pretty generally agreed that a man's initiative would never grow or sprout as long as he was living in an atmosphere of fear and trembling that something he was going to do would not meet with the approval of the "boss." No person seemed inclined to squabble over this, so the dealer went ahead with his story like this:—

"I remember quite well when I was getting my training in the machinery business. After I was taken on the sales force for the Eastern States I came in contact with the men in the shop quite a bit. It was a big concern, and yet it wasn't as big as it should have been. There was the Old Man. He was over all. He was secretary, and head of the sales department. He was everything from office boy to superintendent over the works. He even imagined that he had to lock the safe at night. He really had it in his system that if he were to lay off for a week the whole works would head straight for the dump and there wouldn't be enough left at the end of the week to pay postage on the notice to creditors. Well, the result was this: A man could not develop in that atmosphere. A chap who wanted to get ahead simply had to fight his way, and the way was short and the walls were high. He regarded a man as dangerous and a burden when his salary reached very modest limits. His idea of increasing the revenue was by keeping down the expenses. And he had enough of the stock of the company to make himself felt all over the premises. Salary increases never came there unless they were asked for. and the process of asking required the same qualities that win Victoria Crosses in battle. Well, you can imagine what happened. It was the Old Man this, and the Old Man that. A salesman never felt like doubling up his fists and going out to land a good big order. He had to talk it over with the Old Man first, and his 'thuse would get such a ducking that he would go out like a lame duck. There was never a good deal put across where the man who had done the trick felt like going back to the shop with his chest stuck out and telling the rest of the gang how the thing had been done. The Old Man simply stuck in every person's crop around the whole works, and we were in reality dragging the Old Man with us. He never set the pace for the concern.

Where Bill Comes Into This

"I remember quite well," continued the dealer, "a chap in the shop named Bill. There's always a Bill around a good shop. In fact I don't believe there could be a good shop without a Bill some place around it. Well, this Bill was a mechanic that I learned to admire from the first day I saw him at work. He was a dandy. He knew machinery from the ground up. He was capable of running any machine we had, of doing any operation, of tearing down and putting together and best of all he had the ability to get others to work up to pitch. Bill was the makings of a big man, but the Old Man got him. He was on his trail. He camped on his neck just the same as he did on the rest of us. Bill wasn't developing. He was going to be just plain Bill and that was all. He wasn't going to fill the good big healthy space that he had been carved and fashioned for. Well, to cut this thing shorter, I made up my mind that if I ever got into a place where I could give Bill a chance I was going to send right straight off for him, and see to it that he came along.

"Well, some years after I came to Canada for the Old Man's firm, but now under my own steam. Land, it felt good to be out from under that eternal restraint! I could get out and dig and if the digging was good I got the worms. If it was poor I got nothing. But it was up to me. I didn't have to keep in mind that sooner or later the Old Man would come along and check me up. The business grew here. It has been growing more rapidly of late, and it's going to grow some more in the future. It wasn't long before I wanted a real good man with mechanical training to look after the warehouse end of the establishment which had grown to pretty fair proportions. Did I advertise? Did I go around the city asking this man and that if he knew where I could get a good man? Not much. I knew where my man was. I sent for Bill, and he came.

And Bill Has Made Good

"Some day I'll take you down to the warehouse to meet Bill. He's a dandy. He knows our line of business from A to Z, either going or coming. He can take down any machine that ever comes into the place. He can rebuild or remodel. He can tell a customer almost to a bolt what he requires in the way of equipment, and what Bill says is so, and the trade has come to know it. Do you suppose that I bother with that warehouse now? Not much. When Bill came here first I explained the whole situation to him. We went over the field and lined up what there was in sight. I pointed out that my whole time had to be taken up with chasing business, and the whole staff wanted nothing to do with running the warehouse end of the concern. So we put it straight up to Bill this way: 'Bill, that warehouse is your concern. It's up to you to hop and make it a go from to-day on. Now go to it.' And believe me," concluded the dealer, "Bill hopped, and he made it go, and he's still making it go, and he's the best man in his class in the district. He signs himself to all documents, 'Bill ———, Superintendent of the ——— Co.' He puts that title down as though it was one of the finest things in the world. If Bill's a better man with his title and his dignity why all we say is, 'Reach out and grab for more titles, Bill!' But it does me good to see Bill now and remember the days when he used to be scared to death of the Old Man. Bill is more capable than the Old Man ever thought of being. He can do things that the Old Man would have smothered in their infant stages. And it's all because Bill has elbow room and responsibility. A man can't grow big as long as he has a little man camping on his trail."

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Don't Shut Your Eyes To This

MUNITIONS workers are making good money now. In some cases—in fact, in a good many—they have made more in the last few years than they ever made before. There is no doubt that there is some exaggeration regarding the money that is made in some cases. A big sign on a down-town street reads that men are wanted in a certain munitions plant at wages varying from $4 to $15 per day. If we were going out there to work we would ask for one of the $15 a day jobs in preference to the $4 garden variety. As a matter of fact, $15 per day jobs in munitions plants are scarce.

However, there is no use denying the fact that munitions workers are making big money. The trouble is that they are also spending big money. Go into the stores now, and see what is being bought. Silks, laces, furs, and all sorts of finery. Moving picture shows are jammed to standing room only for three performances a day. Every fakir that opens up a stand gets an audience right straight off.

Munitions is the big business in Canada right now. People on the outside hardly realize how the whole industrial machinery of the nation has drifted over to the war order business. It is not an exaggeration to say that munitions and war orders comprise 85 per cent. of the total business moving in the industrial world in this country.

When the war is over and that is cut off, what then?

The purpose of this article is not to discuss after-war trade, but to get the munition worker to look straight at it.

Here is a case. It is not supposititious, but real. A barber who had machine shop training left the barber shop for the munitions business. He had for years been making around $16 per week. His family lived at the $16 mark. His buying power was $16. For three years he has never made less than $45 per week. What happened? His plane of living was higher. His purchasing power had increased almost three times. He was now a purchasing factor of $45 per week as against his old $16. His family tastes came up to the new mark. We will grant that some of the difference would be readily absorbed by the high cost of living. But apart from that there should have been a margin of safety that could readily have been covered by a savings account or an investment in war loans or some other good security.

This family is having a good time. They are not saving money. And that family is not in a class by itself. The word thrift has absolutely been kicked from the premises in a good many similar cases.

The head of that house cannot see past the end of his nose. If he could he would see this:

(1) The war is going to end some day.

(2) The manufacture of munitions will cease about the same time.

(3) His $45 pay envelope may look as though it had been struck with a six-inch shell.

We do not argue that he will be roaming the streets looking for work. But he is now working at an abnormal occupation, and with the elimination of competition he is able to secure wages that he is not capable of making in normal times.

If you are passing through a season of prosperity don't forget that your prosperity is being bought and paid for with the blood of your fellows on the Western front.

Don't forget that your season of prosperity is not going to last forever. And don't let yourself be jockeyed into the fool position of having played the modern role of the prodigal son. Get that word THRIFT into your system, and you will improve your chances of not being dizzy when the munitions business falls off.

The Real Meaning of Success

J. J. WARREN, managing director of the Consolidated Mining and Smelting Co. of Canada, at Rossland, B.C., has announced that the company will give a $500 scholarship to the "son of any employee of the company working at day labor, who heads his class in the matriculation examinations for applied science in the British Columbia University."

The stipulation that the boy shall be the son of a man working at day labor is not a form of patronage. It faces a condition that actually exists, viz., that the son of a day laborer as a general thing stands a very poor chance of getting a course in applied science at a university. Too often the force of circumstances that made the father a day laborer is operating to do the same thing to the son.

The company that gets close to its employees—that sees in industrial life something more than clock punching and dividend notices—that wants the sons of its day laborers to have a chance to occupy better positions—that company is going to succeed in the higher meaning of the word success.

For after all success cannot be measured entirely by the expansion of plants, the paying of dividends or the declaring of bonuses.

Spencer in Omaha World-Herald

Plucked !

REWARDING INITIATIVE IS TO SECURE MORE OF IT

Frank E. Wall, General Manager of the Polson Iron Works, Has Filled Many Responsible Positions

"THERE'S what I mean by initiative." The speaker indicated a small gripping device on his desk. "Of our sixteen hundred men," he continued, "I told you that about fifty study at night. One of these studious boys made that and brought it to me."

The speaker was Mr. Frank E. Wall, general manager of the Polson Iron Works, Limited, Toronto.

FRANK E. WALL

The gripping device was a most practical-looking metal chuck. In size and outward appearance it was not unlike an old-fashioned wooden potato-masher. But that five-inch projection—corresponding to the rounded handle of the potato-masher—was square.

"It will save labor and time hitherto required for squaring ends of stay-bolts red hot under the hammer," Mr. Wall explained. "You know how a stay-bolt is ordinarily put in: the end squared to provide a gripping surface. Then, when the bolt is in place, the squared end is cut off, leaving about one inch protruding, which is riveted tight to the boiler plate. Well, this chuck grips the staybolt without it having been squared, and this"—his hand slid along the squared handle-like projection of the chuck—"this gives the gripping surface required to put the bolt in place."

Mr. Wall leaned back in his chair, an appreciative smile prefacing his next remark.

"I am sending a personal letter to the young man who made that chuck and with my letter a tidy cheque. It may be an incentive to other men in our plant."

"And to other men in other plants," was the unspoken thought of CANADIAN MACHINERY.

Came Early to America

In London, England, thirty-five years ago, Frank E. Wall was born. A year later the Statue of Liberty greeted him and his parents and, in due time, the public schools of the Republic taught him the three R's. High school and University beckoned, but his chosen work called.

Consequently, before his twentieth year, young Wall had completed his apprenticeship and was well advanced in a course of study under the private tutelage of a man who, in the words of his one-time pupil, "is the peer of the best naval engineer that ever put ships on paper."

The year 1905 found Mr. Wall in the United States Navy yards at Norfolk, Va., filling his first situation of importance. From then on he held responsible positions, one an appointment to the engineering staff of the Public Utilities Commission of New York City. The subways, then in course of construction, presented engineering problems that Wall helped to solve.

Along in 1915 the Mobile Shipbuilding Corporation had scouts out for a man capable of designing and supervising the erection of a new shipbuilding plant. Wall's record marked him as a likely man for the job. But Wall himself didn't look older than his thirty-two years. He moved to Mobile, Alabama. The more he heard of the Mobile plant the more he wanted to build it. And he did build it—so thoroughly well that Uncle Sam at war wanted him.

So 1917 found Frank E. Wall with the United States Shipping Board as a supervisor of steel ship construction. And here he remained until the Spring of 1918, when he accepted the position he has since filled with credit to himself and to Polson's.

"Not a book on shipbuilding or mechanics—not a paper worth reading—gets by; study them all," said Mr. Wall. And that from a young man in a big position is a fine appreciation to the technical press.

A photograph? Mr. Wall was persuaded. He found many of work and one of particular interest that had nothing to do with work. It was a snapshot of Mrs. Frank E. Wall and their little family of four.

"I thank her for my success—for eighty per cent. of it," Mr. Wall said seriously in conclusion.

Don't Grouch About the Coal

THEY say that coal is scarce this year, and I guess that guess is right, and you'll shiver by the light of day and have cold feet at night—and you'll have to burn up wood and straw and sift the ashes too, and the chances are your nose will be both petrified and blue.

But they're callin' for the coal this year to make things into steel, to give the Kaiser shells to eat every bloomin' meal.

They're needin' coal to make the steel they roll out into plate, for puttin' vessels on the sea for us to navigate, and cart across the men and guns, and stuff for them to eat, when they're proddin' at the Germans for to keep 'em in retreat.

They're needin' coal to make the steel that builds the railway track, that carries up our guns and men to beat the German back.

They're needin' coal to run the plants and keep the wheels goin' round, to make the fightin' tools we need to rescue Belgium's ground. And we're needin' coal for this and that, for work what's stiff and stern, so there aint a great pile left, me boy, for you and me to burn.

But some folks go a-shiverin' round and grouch to beat the band, 'bout how they use us stay-at-homes what's dwellin' in this land.

There's howls from every little joint, there's squeaks from every store, there's groans from every little squib who runs a two by four—the whole blame thing is run dead wrong, the coal delivery cart should come around each workin' day and ask them where to start.

Pull on some woolly socks, me boy, get on a flannel shirt, the kind what makes you squirm a bit and say things short and curt—get on some boots with 'ob-niled soles, and take steps big and bold—and for the love of Mike, me boy, forget about the cold.—Ark.

And there's not much sympathy for old H. T. either.

MARKET DEVELOPMENTS

Some Signs Now of Improving Conditions

Larger Shipments of Plate May be Secured—Tin Comes to Point Below the Dollar Mark—Some Talk in Trade Circles of Bringing Out New Style of Shell

FOR the first time in many months it is safe to say that there are signs of a little improvement in some marketing conditions. The plate situation, which has been almost hopeless, shows signs of improving. And the Canadian allotment of material from United States points has been increased by enough tonnage to make the difference noticeable. The shipyards look to the government for their supplies now. Mills at the big producing points in United States have been concentrating on plates for some months, and the result is that there are indications of the demand being overhauled.

The war orders this week from American headquarters in France call for barb wire and steel rails. There was a cessation some days ago in the call for barb wire, but it is probably figured out that new gains can be held move readily with barb wire than with men.

Canadian shops hear rumors of a new shell being brought out in the very near future. It will probably be a changed form of a projectile at present being made largely in this country. Although there is nothing definite in the plans so far, it seems possible that something resembling a streamline shell may be brought out, the claim being that it will have a greater radius in gun fire.

Canadian dealers in machine tools report a normal amount of business with the usual searching around to try and get their deliveries attended to. Dealers in supplies are not certain about deliveries of high speed goods. It is certain that from now on there will be greater delays in this line.

The scrap metal situation is almost at a standstill here. Dealers and consumers tell different stories. The latter state they are having trouble in securing enough good scrap to make up for the shortage in pig iron. The dealers on the other hand, claim that the steel mills and the foundries are full to the roofs of all the scrap they need. There is very little business moving at present through the scrap dealers' yards, but on the other hand there are a large number of sales being made direct from the producers to the melters.

Tin still comes under the dollar mark, and is selling around 95c. This is quite a come-down for this metal. Only a few weeks ago futures of three months were quoted at $1.50, a long cry from the pre-war average of about 30 cents.

MONTREAL SHIPYARDS ARE NOW GETTING BETTER PLATE SUPPLY

Special to CANADIAN MACHINERY

MONTREAL, Que., September 26.—Unabated activity continues throughout the district with munition making the outstanding feature. In addition to the large order recently received by the Canada Cement for 9.2 inch shells for the American Government, it is reported that an aditional allotment for this size shell has been given to the St. Lawrence Bridge Co. Plans are now being prepared for the new plant of the Canada Cement Co. and building operations will be started at an early date. Several local plants are now working regularly on the forging of the 155 mm. shells and machining operations are rapidly progressing to the production stage. Some delay has been experienced through the inability to obtain necessary machinery on schedule time.

Tension in Steel Situation

No relief has been given to the general steel situation and conditions here are still marked by an extreme shortage in many lines. The scarcity of pig iron has virtually eliminated the commercial market and many foundries operating on this class of work have had great difficulty in meeting the trade requirements. In some cases business has been partly maintained by using larger quantities of scrap, but even here the available supply is not equal to the demand. The War Trade Board will only furnish the raw material to those working on the most essential war enterprise. This also applies to other lines of steel activity so that considerable tension is felt in general manufacturing establishments owing to the inability to obtain suffcient steel for repairs or replacements. The constant demand for light plates has caused a drain on the dealers and no 3-16 inch plates are available in Montreal. This is a size constantly asked for owing to its suitability for tank repairs and replacements. The importance of this phase of industrial requirement has apparently not been fully recognized by the War Trade Board and essential activities are in danger of suspending business, in part, for want of facilities to maintain maximum production.

One dealer here states that he could obtain all his requirements from Pittsburg if the War Trade Board at Ottawa would only sanction his efforts to secure the necessary material. To this end the dealer is going to Ottawa to interview the Board on behalf of those manufacturers in need of this and other material required for plant maintenance.

A feature of present conditions is the satisfaction among Canadian shipbuilders over the regular shipments of plates from American mills and in most cases the yards here are nearing easy street respecting their requirements for present and early future activity. It is the opinion of dealers here that the plate situation may shortly take on an easier tone, as a result of the present large production, a factor that will influence the market once the yards are supplied with ample material.

Metals Slightly Easier

The metal situation is not marked by any special developments but an easier tone seems apparent in tin, spelter and antimony. Difficulty is still experienced in securing supplies as it requires authorization of the War Trade Board before requirements can be filled. This often entails delay in obtaining shipments. Ingot coppers continue steady on regular demand with quotations firm at 31 and 32 cents. Tin is coming through more regularly and dealers report a relief in the situation; quotations have declined and the price asked averages $1 per pound. Supplies of spelter are more plentiful and quotations of 10¾c show a decline of ¼c per pound. Lead is unchanged at 10½c, with the demand normal. Antimony is lower on a well supplied market, this week's quotation of 16c being a decline of ½c. Aluminum demand is normal with quotations firm at 50c per pound.

Normal Machine Demand

Activity in the machine tool industry has not been pronounced but the demands are still sufficient to maintain considerable interest among the dealers. Inquiry for some heavy equipment suitable for the 9.2 inch shells has featured the week's business and some sales have been recorded. The requirements for tools for the 155 mm. shells are still unfilled but this is owing to the non-delivery of equipment now on order. Definite delivery on shell machinery is still an uncertain factor, especially where tools are brought in from the States. Considerable activity is being maintained in used equipment that can be adapted for use on the American shells. In some cases this is adopted as a temporary expedient while awaiting shipment of new machinery.

Good Demand for Steel Scrap

With the bulk of the trading virtually controlled through agents of the Imperial Munitions Board, the business passing through the dealers' hands is confined to general activity. Where material is wanted in a hurry the consumer will often apply to a dealer for supplies as the latter will generally give the matter immediate attention, whereas considerable indifference has frequently been shown by those handling the scrap for the Imperial Munitions Board. The demand for steel scrap is very constant and the visible supply is far from adequate to meet the full requirements of the trade. This is particularly true as to cast iron scrap which is taken up quickly owing to the inability to secure pig. The market in scrap metals is dull but a steady business is still carried on by the dealers, who are called upon to supply the needs of the smaller manufacturers. Few price changes are effective, the market generally being firm and strong. Cast borings are now selling at $11 per ton on good demand. Stove plate is scarce with the week's quotation of $32 showing an advance of $2 per ton.

POINTS IN WEEK'S MARKETING NOTES

A new shell may be brought out, the lines of which will be changed to give a greater taper at and toward the base. Greater radius of fire is the end aimed at.

—

The allotment of steel given to Canadian industries has been increased about 50 per cent. in the last few weeks.

—

Tin is selling below the $1 per pound market, as against probable $1.35 to $1.50 quoted a month or so ago. Pre-war prices were around 30 cents per pound.

—

U. S. dealers advise Canadian trade that deliveries are not likely to be as prompt during the coming months, especially for supplies in high speed goods.

—

The scrap metal situation is almost stagnant at present. Sales are not numerous, and yards, the dealers claim, are well stocked with material.

—

There is a big call for barbed wire for the Allies in France. Only a few weeks ago it was announced that little was needed. Apparently it is considered better to use wire to hold new lines than men.

—

Munitions shops in Toronto report in several cases that they can secure all the labor they require. Tool makers, though, are in demand at several places.

—

The big call now is for shell steel and rails, both of them indicating and following the programme of the offensive on the Western front.

—

American steel trade is greatly taken with the idea that the present advances in France are aimed at the district in which Germany gets the great bulk of her steel.

NEW SHELL MAY BE BROUGHT OUT

There is considerable talk about the changing of the style of one of the shells now largely made in Canadian shops, and for which large contracts are still unfilled. It is known that the British have given up the use of the large shells as made here now, and that the Germans are securing a much larger range by having changed the construction of the shell.

Of course it will be some time before any changes can be made here, but the matter is being discussed. The principal idea will be changing the formation of the base of the shell. This may be done by the introduction of a tapering line, giving the shell a streamline effect, to use an automobile term. The flat end now in use has the effect of producing considerable vacuum or suction in its wake, by the nature of the air waves that it brings into existence. The changing of the lines of the shell would be done with the idea of reducing this as far as possible. It may be that some of the Canadian plants will be putting in shops for the turning out of this new product before so very long.

SITUATION EASIER NOW IN SOME LINES

Larger Amount of Material Will Be Sent Here From Across the Border

TORONTO.—"It's all a matter of making deliveries. That's more the point than the securing of the sales." That's the way one big firm sized up the situation to-day, and it seems to be the experience of a good many lines that are catering to the munitions industry. Deliveries from United States points are not so prompt as they have been, and the indications are that they are not going to improve either.

It looks as though the situation in some lines might be going to ease up a little. At least the trade feels that prospects are better than for some time past. For instance the business of building ships in Canada is now looked after by the Ottawa authorities as far as the supply of material is concerned, and the jobbers are no longer booking the plate business for the yards. Of course that may mean that the jobbers will get less material, but it also means that there is more material coming to the country. As a matter of fact that is the case.

The Canadian Allotment

Toronto warehouses are far from well stocked in plates or sheets. But they are expecting that trade in plates will be easier. They have assurance that the Canadian allotment has been increased by almost fifty per cent. per week. This has been made possible by the cutting off of industries in the United States that could not come up to the classing that would put them down as essentials. The output of plate has also been increased by changing a large number of mills from rolling sheets. Steel is shipped to Canada at the rate of 1,500 tons per week. Of course that refers to material heavier than No. 11 gauge. There is a large amount of stuff coming in under that size, though, and there is a tendency to get consumers to use the lighter material. For instance a requisition for flooring for a military hospital is turned down at Ottawa and the advice given that a sheet lighter than 11 should be secured.

Figure It Out Themselves

Local dealers have received schedules showing just what the various ratings given by the Washington authorities mean. This is done so that jobbers and others can study the list and find out for themselves just where they stand in the line. The chances are that there would hardly be room in Washington for enough clerical help to figure out where all the varied interests stand on the preference and priority lists. As a matter of fact Ottawa shows a tendency now to weed out orders more strictly than was the case a few months ago.

There have been no price changes, and it is not likely that any will be made in the next few weeks, although that is a dangerous statement to make.

The situation does seem easier in so far as the securing of material is concerned, but there is no possibility of the supply getting neck and neck with the demand and creating a surplus.

The Scrap Metal Field

There does not seem to be a very large volume of business moving through the local yards. The dealers are very positive in their statments that there is a great deal of scrap metal in the yards of the steel mills and the foundries. "In some places they are fairly clogged with scrap, so much so that they are asking that deliveries to them shall be deferred for a few weeks," declared one dealer. And there are a good many foundries that have never had so much scrap under their shed roofs. I am not inclined to take very seriously the stories we hear about a shortage of material. There is nothing to indicate any such thing. Prices are not going down yet, but one thing is certain, and that is that they are not firm. As soon as a seller or buyer comes in here the first thing spoken of is a lower price for scrap. There is no saying where it may lead to."

No price changes are noted in the local market this week.

Deliveries Are Slower

Representatives of several American firms were in Toronto to-day. They advised agents in several cases that deliveries would be slower in future than for some months past. Recently from three to four weeks has been a safe working distance on orders for supplies, especially in high speed lines. "It looks as though from ten to twelve weeks will be the best we can do now," stated one of the dealers. "This means that Canadian dealers will have to stock more extensively, or that big jobbers in United States will get a bigger share of the business.

The supply business has been great during the last month or so. In fact it is some time since there has been such a volume of business passing as has been registered during the last month.

Tin Below Dollar Mark

Tin is trading below the dollar mark. Its career has been a wild and a merry one, for not long ago futures were looking good for $1.50 a pound, whereas tin used to sell around thirty cents. There has been a good deal of wind and speculation pumped into the tin situation. Of course the shipping facilities have been none too good, and the chances are that a good many bottoms with their tin cargoes have gone to the bottom of the ocean. But even so there was nothing to warrant that $1.50 flight, and the fact that the trading is to-day going on between 90 and 95 cents shows that a saner level is being rapidly reached. Prices of other non-ferrous metals remain unchanged.

WILL FINE FIRMS USING PIG IRON FOR WORK THAT IS NOT ESSENTIAL

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., Sept. 26.—Military tactics certainly change rapidly. It is only a few weeks ago that a light demand for barb wire was noted, because the Allied forces were advancing. Now there is a tremendous demand for barb wire, and it does not mean that the forces expect to stop advancing. Apparently it is considered better to hold gained ground with wire than with men. Heavy orders for barb wire have been placed in the past few weeks, over 50,000 tons, and 150,000 tons or more is immediately on the boards. The size of individual orders, however, is not indicative, as the time element in delivery enters. It is more illuminating to note that the barb wire making capacity, running the usual single turn, is about 50,000 tons a month and the authorities are considering the making of arrangements whereby some of the barb wire departments will run a night turn also, because 50,000 tons of barb wire a month does not seem to be sufficient. The wire makers seem to expect the demand to continue throughout the war, hence they have become concerned as to the large tonnages that will at some time or other be left unemployed. They have pointed out, therefore, that the painted barb wire commonly used in the military operations deteriorates rapidly and is not salable in large quantities for ordinary purposes. Hence they suggest that a larger proportion of the orders be for galvanized wire.

More Steel Conservation

Week by week the military operations call for more steel for direct use, this being a reflection of the aggressiveness of the Allied forces and the advances they are making. The increases are chiefly in shells and rails, although there are many other items. As the raw steel supply is only so much, there must be further curtailment in the consumption of steel for the less direct war purposes, and every finishing line in the steel industry that can possibly yield any steel for the direct purposes is being minutely studied. Illustrative of the fact that the War Industries Board is overlooking no tricks, however unimportant relatively, the tin can, apparently insignificant, continues to receive close attention. Our letter a week ago noted that the allotment of steel sheet bars to the tin plate mills, representing hitherto a full supply, had just been cut by 30 per cent. for the fourth quarter of the year, the occasion being the close of the canning season. It turns out that did not end the case. The conservation division of the War Industries Board has since been holding daily meetings, one line per day, with the packers of various non-perishable food products, for the purpose of arranging a curtailment in their tin plate consumption. It will be understood, of course, that at no time has any tin plate been allowed to go out except on Government orders and for food products. The expectation is that the absolute requirements in tin plate will be so curtailed that it will be possible to get along with the tin plate mills operating at still less than 70 per cent. of capacity. As noted in last report, it requires about a million two-pound cans to release the amount of steel needed to provide rails for one mile of track, so that it requires a great deal of industry on the part of the Conservation Division to enable General Pershing to lay more miles of track for the big guns that will be pointed at the Metz stronghold, and for other purposes. Incidentally, it may be mentioned that the American steel trade is quite thrilled by the idea that the advances in the Lorraine district are aimed at the territory whence the enemy obtains the great bulk of his steel.

How About Pipe?

Conservation of steel in connection with tin plate is only one item. A meeting is scheduled for to-day with the pipe mills, to consider how much curtailment in the use of steel for pipe making can be effected without serious derangement to the supplies of pipe for direct war purposes for shipbuilding, and the most essential commercial operations. With the greatly increased barb wire demands there will be no further curtailment in wire manufacture as a whole, but some wire products may yield wire to be made into the barb variety. The merchant bar mills are being given further consideration.

For the time being at least there is to be no further curtailment in steel for sheet mills. The supply permitted an operation of about 57 per cent. of capacity in July and the August average was just a shade higher, while present operations are close to 60 per cent. Sheet requirements for war purposes have increased somewhat in the past few weeks and with a 60 per cent. sheet mill operation there will be less sheets for the preference industries, but more for direct war use.

The 33,000,000 Semisteel Shells

Foundrymen are making progress in their study of the semisteel shell program, referred to in last report, the Ordnance Department having announced that it requires 33,000,000 semisteel shells in the next ten months and that it expects the major portion to be made in this district. While a definite announcement was made, detailed in last report, as to the sizes of shells and the description, whether shrapnel or high explosive, it is now very definitely rumored that the department wants more gas shells than shrapnel or high explosive and it may be therefore that the total of semisteel shells will exceed the figures already given.

Local foundrymen do not expect to encounter much difficulty in making the shells to specifications, provided they are furnished the pig iron, and there's the rub. There has been no free pig iron in this district for months, all the output going on contracts involving the filling of war orders or on allocations either for the filling of war orders or for export. The proportion of foundry iron in the total make has been unprecedently small and this foundry iron has been going for the manufacture of mill and other machinery and quite essential requirements. A general committee for the country was delegated a fortnight ago to seek cases of foundries employing pig iron for purposes that could be dispensed with, but indications are it has found very little. A general meeting of pig iron manufacturers and the War Industries Board was held in Washington last Monday to discuss the problems of increasing production and allotment of foundry iron orders in connection with the semisteel shell orders that are to be placed. This was one of a series of meetings aimed chiefly at speeding up production, the pipe, plate and structural shape makers to be met in turn, one group each day.

Coke and Pig Iron

All the investigations thus far have pointed to the same conclusion, that the chief barrier to a heavier production of steel is the quality of coke that many furnaces are forced to use. There are other barriers, but this is regarded as the chief. Coke production in the United States in the last week reported upon was the largest on record, with but two exceptions, and the gain in production, compared with the rate in 1916, would, by proportion with the 1916 pig iron output, compass a pig iron output now at the rate of 44,000,000 tons per annum, whereas for several months past the rate has fluctuated within the limits of 40,000,000 and 41,000,000 tons. A comparison of the number and capacity of furnaces in blast, considering their past performances, also indicates that with similarly favorable conditions the rate of output now should be close to 44,000,000 tons a year. With more pig iron, more steel would be made. The Fuel Administration is increasing its inspection force as rapidly as possible, and purposes to penalize, in price, all coke that is not up to standard in quality. It appears that operators and miners are both in part responsible, some operators being less careful than usual, while miners are not careful to take out clean coal, and any refuse mined increases the ash in the coke and thereby reduces the daily output of the furnace using it.

AUTO AND STOVE SHOPS ARE TAKING ON WAR CONTRACTS NOW

Special to CANADIAN MACHINERY.

NEW YORK, Sept. 26.—Machinery manufacturers and dealers are receiving a number of orders for shop equipment from manufacturers of small arms, shells and airplane motors. The Government is also placing direct orders for equipping machine shops at shell-loading plants and at army cantonments. Provision is also being made by the Ordnance Department to increase capacity of arsenals for making large calibre guns and the Navy Department is constantly buying machinery to be installed at Navy Yards and repair shops.

Several new contracts for automatic pistols have been placed by the War Department and similar contracts are pending, while manufacturers receiving these contracts are buying additional tools. The Winchester Repeating Arms Co., New Haven, Conn., and Landers, Frary & Clark, New Britain, Conn., have already closed on fair sized lists of tools for making pistols. A contract has also been given to the National Cash Register Co., Dayton, Ohio, for army pistols and a large similar contract is on the point of being closed by a Philadelphia company that will require several hundred Lincoln type milling machines and other tools.

The Stove Foundries

Stove founders are rapidly taking on war work including several large contracts for semisteel shells of which about 20,000,000 are wanted by the Ordnance Department. Several of the large pipe shops are already casting such shells and other founders are rapidly converting their plants for similar work. Rathbone, Sard & Co., stove makers, are buying machining tools for semisteel shells which they will cast at their Albany, N.Y., and at their Aurora, Ill., plants. The Michigan Stove Co., Detroit, and the Foster, Merriam Co., Meriden., Conn., have also taken shell contracts and are soon expected to enter the market for machine tools. The Savage Arms Corporation has placed a $125,000 order for tools for its Philadelphia plant, recently acquired from Isaac A. Sheppard & Co. Gun mounts for 3-inch guns will be manufactured. Machinery is also being moved from the Sharon, Pa., plant of the Savage Arms Corporation, and also from the plant of the Defiance Manufacturing plant at Philadelphia, which was recently acquired by the Savage Arms interest.

New Arsenal

The War Department has purchased several tools for each of 27 cantonments for equipping machine shops and the Government has also purchased several hundred tools for machine shops at shell-loading plants. The Ordnance Department has secured a tract of land at Philadelphia as a site for an arsenal to produce large calibre guns; $136,405 was paid for the land, and bids are now being taken on additional buildings to be erected at the Frankford arsenal.

The Navy Department has secured under a twenty-year lease the water front property on New York Bay belonging to I. T. Williams & Sons, for the building of a large dry dock and ship repair works; the property has a water frontage of 1,500 feet and the aggregate rental is about $1,300,000. The Government has also taken over the plant of the Merritt-Chapman Derrick & Wreckage Co. in the same section, which will be utilized in ship repairing and reclaiming work.

Auto Shops Changing

Automobile manufacturers and makers of automobile parts are more actively buying tools for war work. The Hudson Motor Car Co., Detroit, has inquiries out for shop equipment which will permit the manufacture of 2,000 155-mm. shells a day. The Ford Motor Co., Detroit, and the Buick Motor Car Co., Flint, Michigan, have purchased additional machinery to increase output of Liberty engines. The Ford Co. is also still buying for its Hamilton, Ohio, plant and other purchases are contemplated for tools to build 10,000 two-man tanks. The American Brake Shoe & Foundry Co. has placed orders for a portion of the 150 machines called for last week, to be used in the manufacture of guns and projectiles. The H. H. Franklin Manufacturing Co., Syracuse, N.Y., is placing orders for machine tools for airplane motor parts. It has recently taken orders for crank shafts from the Pierce-Arrow Co., Buffalo, and the Wright-Morton Aircraft Corp.

IRON PRODUCERS WANT TO GET HIGHER FIGURE IN NEXT QUARTER

ALTHOUGH it will be some time before a definite announcement will be made regarding the matter, it is quite apparent that the iron interests in United States are pressing for higher prices for pig iron for the next quarter, and it wouldn't cause any surprise were an announcement made to this effect. The foundry pig iron producers decided at their meeting that their case must be presented separately at Washington and not through the General Steel Committee. It is well known, though, at Washington that there is little encouragement to the plea for higher prices. American points of production reports as follows:

Pittsburg.—It is a matter of fact that hardly any sales are being made here now at all. The entire output of pig iron that is not used by the steel companies is being allocated by the Government, so that no new sales are being made. It is also claimed that very little iron has been sold for the first half of next year delivery.

Chicago.—The allotments of pig iron that are being made in this district are so large that there is a serious problem ahead of the furnaces in filling them. Some rather peculiar situations are developing, too. It is natural for the furnace men to want to take care of their old customers, all of whom are on important Government work.

St. Louis.—Some of the foundries in this district are having a hard time in lining up with the essential industries. Notable among these are the stove foundries who are so limited in their domestic output as to be on the verge of shutting down. There is nothing to indicate that there will be much improvement in their business in the near future.

New York.—At the recent meeting of the pig iron manufacturers some of the furnaces from Tennesee showed actual costs amounting to 40 dollars a ton, and some of the Pennsylvania men also assert that their costs amounted to $38 a ton. A good many of them state positively they are losing money and cannot continue in business.

Cleveland.—The scarcity of pig iron is growing rather acute here, and there is nothing like enough to go round. Stocks in the furnace yards are becoming very low and many of the consumers have only a few days' supply.

Many of the allotments made by the Government call for delivery of iron to small and almost unknown melters, who have never had any dealing with the pig iron men before. However, there is no choice in the matter and the orders have to be filled.

Philadelphia. — The agitation for higher price for pig iron is going on strong in this district. It was stated at one of the recent meetings of the steel men here that out of a total production of iron of 8 million tons at least one-eighth of that amount is now being made at an actual loss, and it was also claimed that producers whose costs exceeded selling prices cannot continue to operate under these conditions, and the claim is also made that Judge Gary has agreed to press the claim for higher prices for iron at Washington.

Buffalo. — Government allotments practically take up the entire output of the furnaces here. Transportation is a little better than it has been for some time past, but furnace men are making all possible efforts to speed up shipments and get their books cleared up before the setting in of winter business.

DEALERS IN SCRAP SAY THERE IS LITTLE MONEY TO BE MADE NOW

THE scrap metal situation on the American side is that more and more it is coming under the control of the Government. There is an agitation on in a great many places for an increase in the price, but so far has met with very little success. The state of the trade in the principal points in U. S. is as follows:

Pittsburg—Very few sales are being made through the yards here, as the entire output of much munition scrap is taken by the Government. It is positively stated that no advances will be made in prices of any kind of scrap, and it is also claimed that a few reductions may be looked for. The supply of scrap is reported as being fairly large and several dealers report that they are moving more material to customers than for some time.

Chicago—The general situation in the scrap market here is one of a large demand and a small supply, there apparently being not enough scrap in existence. The demand is not for any particular line, but it is very general, and shipments are wanted quickly.

Philadelphia.—The embargo that was placed on shipments of borings and turnings to blast furnaces which was recently put into effect has not resulted in securing the amount of material that was expected. Trading is done at the Government maximum in nearly every case.

Buffalo.—There is a very active demand here this week for practically every line, and there is an equally marked scarcity of materials to meet it. Stocks in the yards are very low for this time of the year, and the dealers are unable to gather sufficient quantities to equal anything like the tonnages that are being called for. The labor situation here is also very bad, and it makes it extremely difficult for the yards to sort and handle the material that is being offered.

St. Louis.—There has been quite a readjustment of prices here in regard to scrap, and this is being helped along by the fact that railroads are not being permitted to offer cast scrap of any grade or class, this also being true of car wheels, brake bars, arch bars, etc., while very few axles are being put out for general bidding. Many of the consumers here are using material of all classes and grades and there is nothing offered at the present time which does not find a very ready sale.

Cleveland.—There is a very heavy melting steel, but the limited supply is restricting the sales.

Cincinnati. — Number 1 machinery scrap is in very heavy demand here and the dealers in nearly every case are able to obtain without any difficulty amid the Government maximum price of $34.00 per gross ton delivered at consumer's plant.

ACETIC ACID AND ACETONE

Continued from page 370

tained in Germany in 1913; by the second, some 20,000 tons.

The dry distillation of grey lime produces acetone, which is used for soaking nitro-cellulose and also as a solvent. In the last years of peace it began to receive attention in connection with artificial rubber, and this utilization of acetone took on great dimensions during the war, so great that neither the German nor the Austro-Hungarian timber industries were able to meet it. Before the war the former worked up some 17,000 tons of home-produced grey lime. Apart from that, 20,000 tons of grey lime were imported annually from America, and this supply has now ceased owing to the blockdale.

To fill up the gap a new industry came into existence—the synthetic production of acetic acid and acetone from calcium carbide. Calcium carbide, which is made of lime and coke, can be manufactured in Germany in unlimited quantities. The present output is estimated at 400,000 tons. The establishment for making acetic acid and acetone out of calcium carbide is the Dr. Alexander Wacker Company for the Electro-Chemical Industry.

After giving a brief technical description of the processes adopted by this company, the writer proceeds to say that before the war 3.4 million cwt. of potatoes were annually fermented into acetic acid. In addition, some 4 million marks' worth of grey lime was imported into Germany. In contrast with this the factories which have been opened during the war for synthetic manufacture of acetic acid from carbide, that is to say, out of home products, are well able to satisfy the whole German requirements of acids and vinegar. The new industry promises to be very vigorous, and there is little fear that in the future so valuable a foodstuff as potatoes will be turned into acetic acid.

Germany has come to the end of her tether in many vital raw materials not produced in enemy countries. Teuton factories are, and will be more, hungry, therefore, for raw materials when the war is over. Germany cannot manufacture without them. Does she deserve any contribution in raw materials from Canada? Germany, for her own domestic requirements and export trade, will be in the market for enormous supplies of raw materials which, with the demands of these portions of Europe which have been devastated, will tax for some considerable time the rest of the world to supply.

The most sanguine optimist, however, is now obliged to view the future with grave concern. A famine in Europe, accompanied by a serious dearth in raw materials, are not only possibilities, which cannot be disputed, but there is every evidence to indicate they cannot be averted.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

	Montreal	Toronto
Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	100 00	95 00
Spelter	16 75	11 00
Lead	10 50	10 00
Antimony	16 00	18 00
Aluminum	50 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 36

Standard Buttweld

Per 100 feet	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	29 97	36 45
2½ in.	45 05	55 28
3 in.	58 91	72 29
3½ in.	73 60	91 54
4 in.	87 20	108 45
4½ in.	99 06	123 82
5 in.	115 40	144 30
6 in.	149 80	187 20
7 in.	195 20	243 95
8L in.	205 00	256 25
8 in.	236 20	295 20
9 in.	282 90	353 25
10L in.	262 40	328 00
10 in.	337 80	422 30

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, 45%.
4½" and larger, 40%.
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	25 00
No. 1 machine composition	23 00	22 00
New brass cuttings	16 50	15 00
Red brass turnings	18 50	18 00
Yellow brass turnings	13 00	13 00
Light brass	10 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	8 00	8 50
Stove plate	32 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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.	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

Colored.

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

Wool Packing.

Arrow	25	Anvil	16
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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

October 3, 1918. Volume XX. No. 14

Organizing for the Production of Forgings

The Proper Forging of the Shell Has Much to do With the Success of All the Following Operations—New Machine Designed For Gauging the Length of the Billets

By J. H. RODGERS, Associate Editor Canadian Machinery.

MANY factors are involved in the manufacture of munitions that control or regulate the output of the plant, but the pivot upon which the entire organization depends for maximum production is undoubtedly the forging of the shells. The efficiency of this operation is the keystone that assures and maintains the smooth running of the other departments and permits of an undisturbed flow of shells through the hands of the inspectors and the subsequent machining. Unless the forged blanks are reasonably accurate, both as to dimensions and to physical structure, it is impossible to expect that the resultant machining can be performed with the greatest degree of effectiveness. It is therefore necessary that every attention be given to the various details of this department to avoid an excessive percentage of rejected shells.

The past four years of practical experience has enabled shell manufacturers to provide facilities that will best meet the requirements for maximum production. Equal in importance to the equipment required for the work is the arrangement of this equipment. Where large quantities of a product are being turned out daily it is very essential that no overlapping takes place during its progress through the various sections of the plant. In order to conserve the energy of the workmen, so that the same may be applied to useful effort, appliances are invariably provided that minimize the physical exertions when the men are handling the work. This is particularly true in relation to the forging of munitions, where operators are subjected to the extreme heat of the furnace and the heated shells, and likewise to the steam and smoke that are unavoidably present during these operations. After the forging process has been completed it is highly desirable that the shell be removed from the vicinity of the presses as early as possible to relieve the men from the heat radiation. In this plant a chain conveyor has been installed, parallel to the line of presses, and the entire length of the shop. At the end farthest from the forging presses the shells are transferred to another conveyor, placed at right angles to the primary one. At the transfer point the receiving plate is so arranged that the shells are permitted to roll on to the second conveyor so that they will rest in the same relative position as they did on the first conveyor. This practice was found to be of great assistance to the men removing the shells as they were able to tell at a gance from which press the shell had come, thus aiding in identifying the heat series of the respective forgings. These were then removed from the conveyors by men on either side and arranged in piles or on the floor according to the carbon content contained in the series. A fuller explanation of this will be given later.

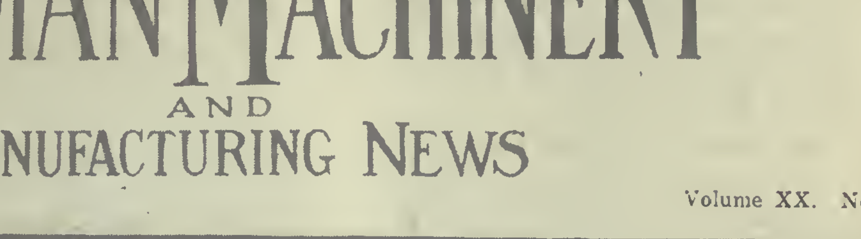


FIG. 2—6-INCH FORGING PUNCH

Furnace Installation

In the forging of the 6 inch shells three furnaces are generally used to supply two presses so that the operations will be continuous. Seven large continuous type furnaces are installed for the heating of the 6 inch billets. Four of these are adapted to take three rows of billets, and have a heating capacity of about 70 per hour. The other furnaces are a little narrower, accommodating two rows of billets and have a capacity of from 35 to 40 per hour. In addition to this installation there are three furnaces, one of which has recently been erected, two of these units have been operating on 75 mm. billets, but will shortly be used both for this shell and the British shrapnel, work on the latter to be started immediately. The furnaces are located in a long row at the rear of the line of presses. All furnaces are oil fired, operating under an oil pressure of 40 pounds, and air pressure of 10 ounces. The average temperature of

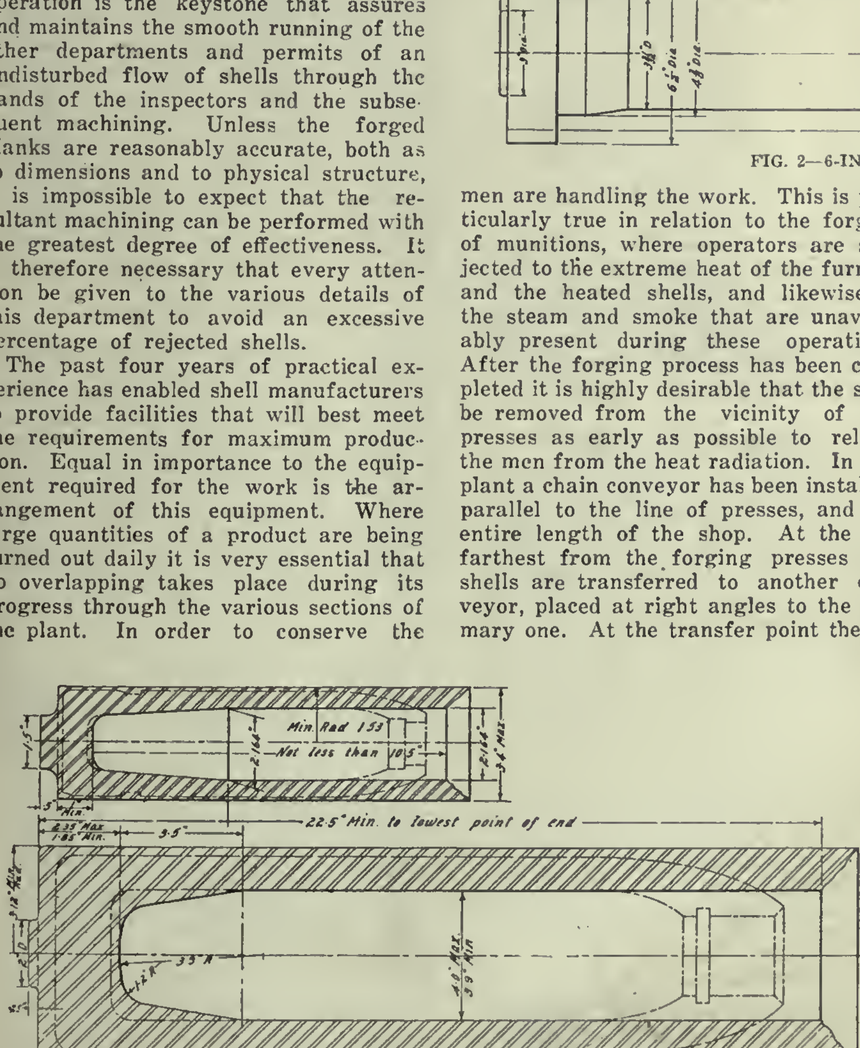


FIG. 1—75-MM. AND 6-INCH SHELL FORGINGS

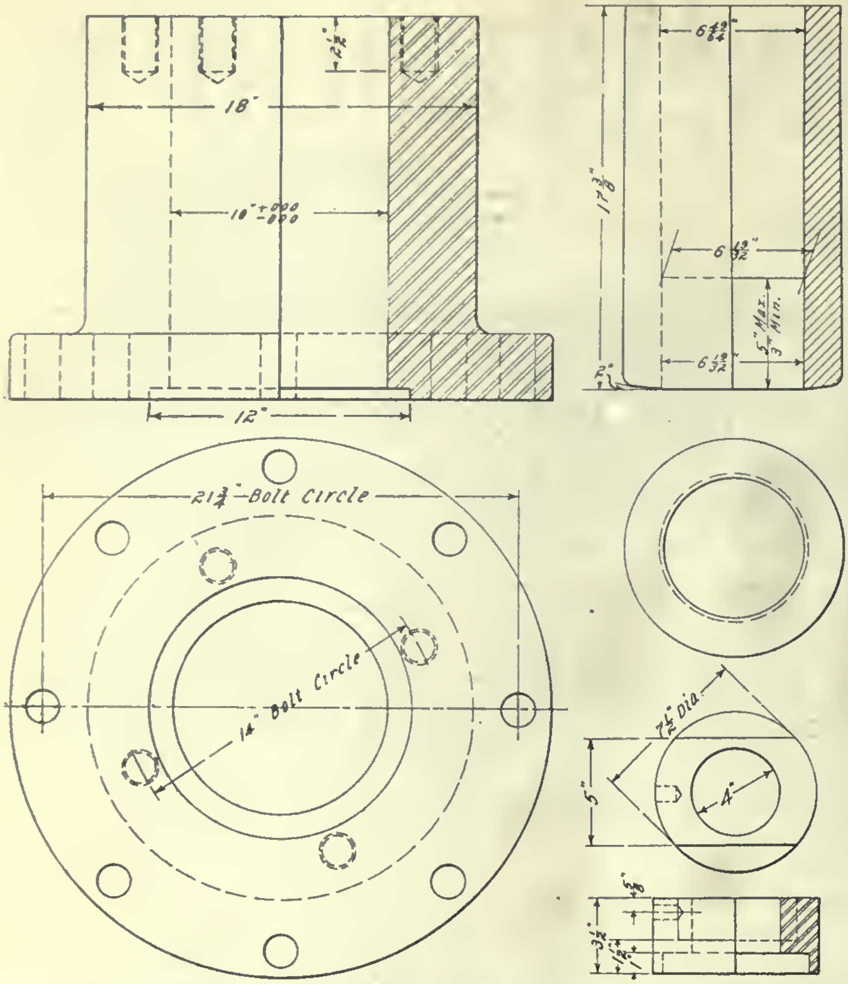


FIG. 3—DIE POT AND BUSHING FOR 6-INCH PRESS

the billets when removed from the furnace is generally between 2000 degrees and 2100 degrees Fahr., but this temperature is frequently regulated to suit the analysis of the steel for each particular heat series.

Square Shaped Billet

The length and inclination of the furnace bottom allows the billets to turn over about six times between the time they are loaded into the furnace and when they are removed at the discharge end. Two types of billets are used at this plant for the production of the 6 inch shell forgings. The round billet, which is the one generally adopted in the majority of forging plants, has a diameter of 6 7-16 inches and an approximate length of 17½ inches, and weighs about 160 pounds. The bulk of the forgings produced at this plant, however, have been made from Gothic steel somewhat square in cross section, with rounded corners and the sides with a slight convex contour. The measurement across the corners is practically the same as the diameter of the round billet but the length is about 21½ inches. In forging from the round billet the metal flows in a vertical direction, but in the case of the square shaped billet the metal is forced sideways to fill up the round die, the upward extrusion being very little, as the average length of the forging is about 22½ inches. It is claimed that these shapes are easier to produce at the mills and also that the presses are less taxed in producing the forgings. Owing to the action of the metal however, there is a slight possibility that the steel would be less dense at those portions of the finished forging formed from the sides of the square-shaped billet.

Forging the 6-inch Shell

In the lower part of Fig. 1 is shown a longitudinal section of a 6-inch forging, with the outline of a finished shell shown in dotted lines. Three 500-ton Southwark hydraulic presses are installed for the 6-inch operations, the normal production being about 50 shells per hour from each press. The punch platten carries two punches in a turret, but only one is in operation at a time, it being located in a central position when forging a shell. Each punch is used alternately, and at each operation the one not in use enters a well of water, kept cool by circulation. This method eliminates the need of the ring cooler generally adopted for this purpose. A sketch of the 6-inch forging punch is illustrated in Fig. 2. These punches are not screwed into the turret but are held in position by means of a binder ring. To aid the punch in entering the center of the billet a centering ring is placed on the top of the billet so that the punch is prevented from crowding to one side, should it show a tendency to do so. A sketch of this ring is shown in the lower right of Fig. 3. The other views are those of the die pot and the die pot bushing. The latter is the renewable piece and is made of chilled cast iron, with an overall length of 17⅝ inches. The hole is tapered from 6 49-64 inches at the top to 6 19-32 inches about four inches from the base, the remaining portion being parallel. Three bushings are held in position by shrinking on the die pot. The forging is produced at one stroke of the press, the shell being stripped from the punch by means of a stripper operating in a slide at the top of the die pot. The shell is ejected by means of a hydraulic kicker.

Conveyor System

To assist in keeping the heat series separate the forged shell from one press are located on the conveyor with the base forward and those from the other press with the open end forward. When the moving shells reach the point where they are removed for cooling this system affords an easy means of identifying the press from which the shells have been produced. A feature of these conveyors is the roller arrangement working in conjunction with the primary chain. The latter is operated by a 15 h.p. motor and travels at a speed of about 100 feet per minute, but the concave rollers, connected by the links of the chain and rolling on the supporting channels, cause the shells to travel at a speed almost double that of the conveyor. The great advantage of this method is that the hot shell never rests in the one spot, so that overheating of the chain or rollers is eliminated. In chain conveyors where this principle is not incorporated trouble has frequently been caused by the slight stretch resulting from the hot shell resting too long a period in the one position.

Primary Cooling

On either side of the second conveyor considerable space is provided for the cooling or piling of the forgings. This cooling process is quite interesting, inasmuch as each series is treated differently according to the initial analysis of the steel and the heating of the billet prior to the forging operation. The specifications call for a steel giving a yield of 19 tons or over, a breaking stress of 50 to 55 tons, and an elongation of 15 per cent. or over. The carbon content should be between .40 and .60 and the manganese between .60 and 1.00 per cent. A steel may be relatively low in carbon and yet sufficiently high in manganese to meet the requirements of the specifications. The constant—230—found by multiplying the carbon content by 3 and adding the percentage of manganese—has been found to be a good guide for subsequent heat treatment. Thus a steel of .52 carbon and .74 manganese will give results of a highly satisfactory character under normal treatment. In general, steels that show a value higher than 230 require a slow cooling process, and those below this should be cooled quickly, the process being modified to conform to specific conditions. For rapid cooling the shells are placed on end on the floor.

so that the heat radiated from the shells will be absorbed by the atmosphere as quickly as possible. This treatment will range from extreme separation of the forgings for low value to close packing under a steel hood for high carbon steels.

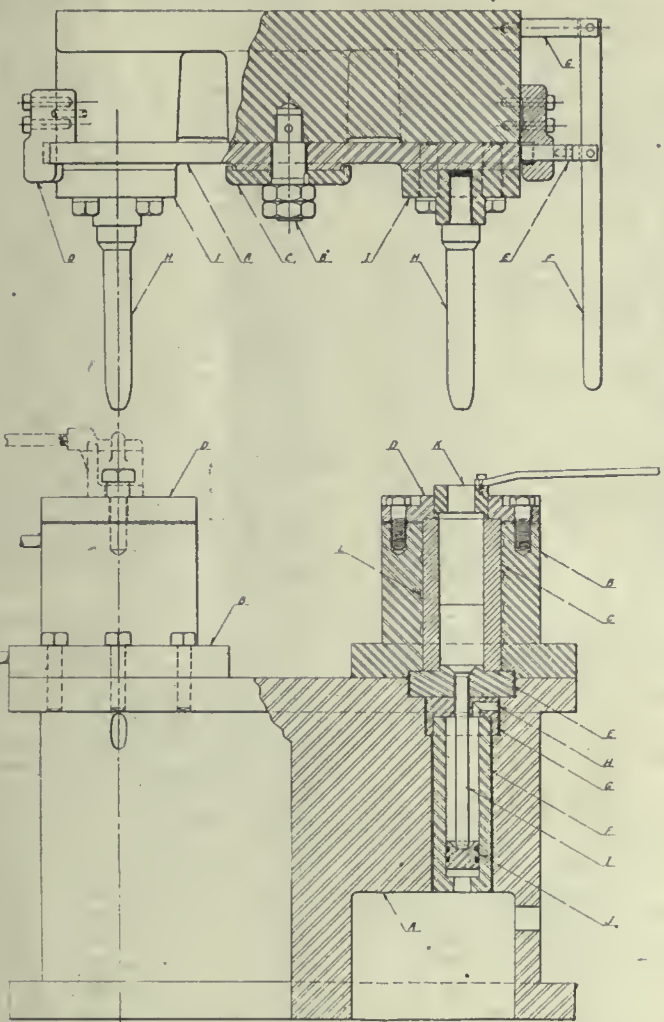


FIG. 4—ASSEMBLY OF TOOLING FOR FIRST FORGING OPERATION.

Special Cooling Apparatus

Additional treatment is frequently required where the original cooling system is not sufficient to meet the end desired. This normalizing process may mean either of two things—shells in which the steel is too soft, requiring to be hardened, or those that are too hard requiring to be annealed. For the former process an elaborate cooling system has been installed which is proving very efficient. For treatment in the oil-fired furnaces the shells are placed on special steel trucks, and so arranged that the heat is evenly distributed to the entire surface of every shell. When loaded to capacity, or the total of that particular heat series, the trucks are drawn into the furnace chamber and the ends closed. After the forgings have been raised to a temperature of approximately 1,500° Fahr. they are removed in lots of eight, which is the capacity of the cooling apparatus. It might be said that these furnaces are practically continuous as the loaded trucks are gradually drawn into the furnace as the heated shells are removed, others being loaded at the opposite end.

The cooling device is so designed that the air is forced against the base, or heaviest portion of the shell; this action takes place simultaneously inside and out, so that the cooling of the entire shell is very uniform. The shell is placed on a hollow mandrel and then shoved into a larger pipe, after which the blast is turned on, the air being delivered to the exterior and interior at the same time. Eight minutes is the average time required to cool the forgings from 1,500 degrees to about 850 degrees, when they are removed and allowed to cool in the usual manner by placing in piles.

Annealing Hard Shells

Reverse treatment is required when the shells show extreme hardness. In this case annealing is essential. The shells are placed in batches on trucks and drawn into the furnace where the temperature is raised to the critical stage, and allowed to soak for a period, after which they are allowed to cool to a lower temperature and then removed from the furnace and placed under cover for slow cooling. The annealing period is generally regulated to suit the analysis of the steel. The treatment of a specific case may serve for illustration. The analysis of a certain steel showed .62 carbon and .92 manganese. This figured out at 48 points above the normal constant 230. A batch of 87 of these shells were placed in the furnace and raised from 650° Fahr. to 1,550° Fahr. in 2 hours and 20 minutes. They were allowed to soak at 1,550° for a period of 2½ hours, then the burners were shut off and the shells allowed to cool to a temperature of about 650°. The loaded truck was then removed and hoods placed over the shells to prevent rapid radiation.

This installation has been of inestimable service in turning out a highly uniform product. The plant is not only used for treating their own product but the capacity is ample to meet the needs of other forge shops.

Cutting Off 75 mm. Billets

The billets for the 75 mm. forgings are obtained from 3⅝ inch round bars, averaging 10 feet in length. The method of cutting these bars into billet lengths, together with the spacing device, is of

FIG. 5—PIERCING AND DRAWING PUNCHES FOR 75MM. FORGINGS.

special interest. As in the case of the heavier shells, every facility is provided to minimize all unnecessary physical effort that would tend to sap the energy of the workmen. Railways and gravity conveyors are installed to carry the bars from the rollway cars to the machines. The spacing machine for gauging the length of the billets was designed by Mr. Beck, the superintendent of the heat-treating department of the Cluff Munitions Co. Previous to the introduction of this device the division of the bars was more or less a matter of guesswork, considerable scrap accumulating from the waste end of each bar. With the new device the bars can be so cut that no waste is evident, the surplus metal being distributed equally among the 12 billets in the average bar. The principle of the design is that of the pantograph, the lattice work being located beneath a long channel iron that forms the frame of the machine; upon the upper surface of this channel is arranged the evenly spaced pieces of angle iron. These are connected to the center pivots of the pantograph by means of machined bolts, latteral travel being provided for by a slot cut through the center of the channel iron. To ensure equal spacing of the gauging surfaces, the network of links is operated from equidistant points, these in turn being operated from and connected to a central lever by means of various length links. The central lever is directly connected to the control lever which is located at one end of the machine.

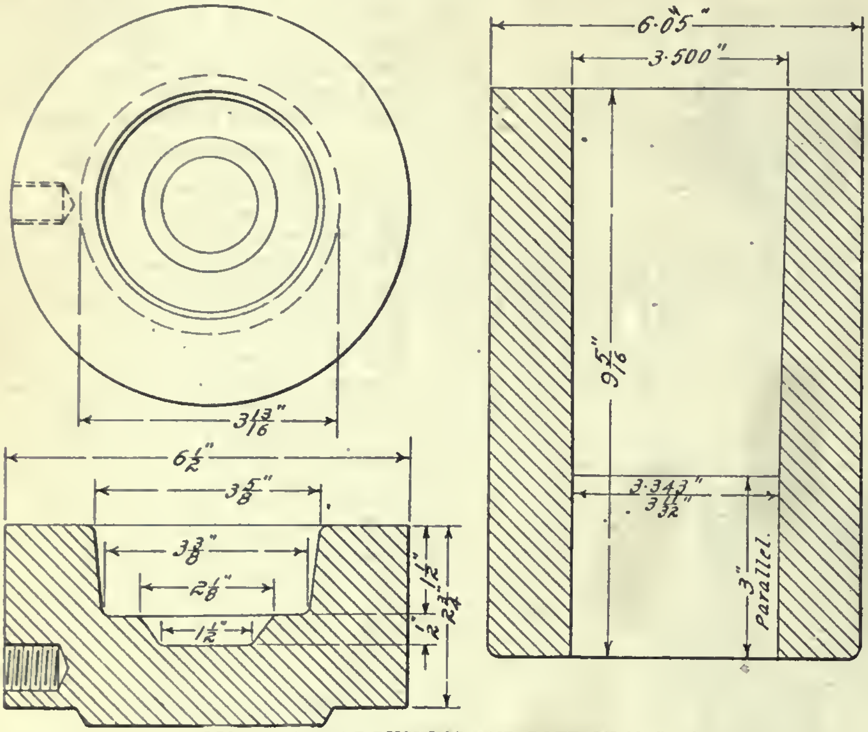


FIG. 6—DIE POT BUSHING AND BOTTOMING PAN

When a bar is placed in position with one end against the initial stop, and it is found that the other end lies between two gauging points, the control lever is moved one way or the other to bring the end in line with the nearest gauging point. Thus, suppose the bar to be 10 feet 3 inches in length and the normal length of a billet to be 10 inches, the usual practice would provide 12 billets with 3 inches of scrap. With the new device this 3 inches can be distributed among the 12 billets, making each 10¼ inches long. When the bar is placed in position, with one end against the forward gauge, the operator with the oxy-acetylene torch commences to nick the bar, the spacing being adjusted by the operator on the other end. The initial gauge is always in a fixed position and is located at the opposite end to the control handle. Any movement of this handle operates the entire pantograph so that the space between each gauge will close or separate an equal amount, but the gauging point farthest from the stationary gauge will travel a distance —one way or the other—equal to the spacing adjustment multiplied by the number of spaces. This adjustment is only a matter of a couple of seconds so that the nicking operator can move from one gauge to the next without troubling about the length of the billets.

After the bars have been nicked with the torch they are rolled down a slight incline to the large geared punch press, where the bars are broken into lengths. The nicked portion is kept at the bottom while the bar is moved beneath the wedge point of the punch. When care is exercised in keeping the nick in a central position a clean square break is invariably obtained. The billets are then placed on a conveyor adjoining the press and carried for about 150 feet to the space reserved at the rear of the furnaces. With the exception of the handling of the billets or forgings at the various machines or furnaces no manual labor is required, as the movement from one operation to the next is performed by the conveyors.

Forging 75 mm. Shells

The heating of the 75 mm. billets is accomplished on the same principle as the larger shells but the furnaces have a capacity for 250 billets. For the forging operations four Southwark presses are installed, two of 350 tons and two of 210 tons capacity. At present one of each is working on the 75 mm., the other two to be utilized for the British shrapnel when work on these shells is under way. The larger of these presses are adapted for the piercing operations and the smaller for the subsequent drawing process. The general practice on these small shells is to forge two at the same time, transferring the pierced billets to the drawing press, so that the complete


SPACING MACHINE DESIGNED BY MR. BECK.

forging operation is accomplished at the one heat.

The details of the mechanism necessary for the primary piercing operation is illustrated in Fig. 4, half of which is shown in section, both sides being identical. The pedestal A is secured to the bed of the press, and carries on the upper surface the die pots B, in which is contained the renewable chilled cast iron bushing C. Located at the bottom of this bushing is the cast steel piece E that shapes the tit on the base of the forging, together with any lettering that may be required for identification purposes. Located in the body of the pedestal is the bushing F, held in position by the collar G, through which is the channel H for the lowering of the plunger J. The kicker pin I is operated by this plunger which travels vertically in the cylinder F. With the die pot B firmly bolted to the pedestal the entire central works are held in position by the binder ring D. Through this binder ring there is a hole—centrally located—to take the centering ring K, the bore of the latter being a sliding fit for the piercing punch, and guiding the latter when in operation. For keeping the

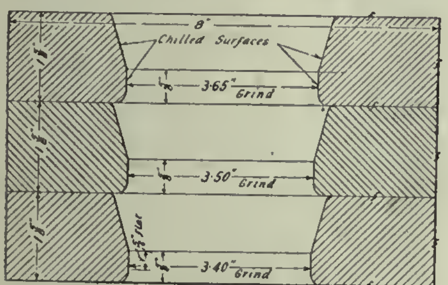


FIG. 8—CHILLED CAST IRON DRAW RINGS.

bushing cool a spiral groove L is cut in the die pot, and through this groove water is kept circulating, so that little trouble is ever experienced by the overheating of the dies.

On the movable ram of the press the turret A is held in position by means of the washer C and the bolt B, bearing brackets D being provided to support the outer edges. If sufficient lift is given to the ram the turret need not be used, but it is frequently found more economical to regulate the stroke of the press and swing the punches clear while removing the forgings. When in a central position the turret is locked by the stop pin E, which is operated by the handle F. The piercing punch H is screwed into and held in position by the binder ring I. Both billets are pierced simultaneously, and when removed from the dies are given to the operators on the drawing press for the final process of drawing to length and sizing the outer diameter.

A sketch of the piercing punch and the details of the nose is shown at the top of Fig. 5. The overall length of the working portion is 12 inches and the diameter of the main section is 2.18 inches, with the exception of the 2¾ inches at the end, this portion being tapered from the body of the punch to a diameter of 1 13-16 inches, the radius of the nose being ¾ inch; the center for a diameter of 5-16 inch having a radius of 2¾ inches. The dimensions of the die pot bushing can be seen in the sketch Fig. 6.

Draw Press Details

The details of the drawing press is shown in Fig. 7. The top plate A that carries the punch holders or adapters C, is bolted to the ram of the press. The upper end of the adapters is provided with a collar and is held in position by means of the binder ring B. The draw punch E is screwed into the holder. The ring and the chills being supported on the steel plate L. When the pierced blanks are first brought to the draw press the base is formed by using the bottoming pan, after which the pan is removed and the blank shoved through the three dies and stripped from the punch by inserting the stripper O.

The sketch of the draw punch and nose dimensions is shown in the lower part of Fig. 5. The wall of the forgings is reduced gradually as it passes through the three cast iron chills, the

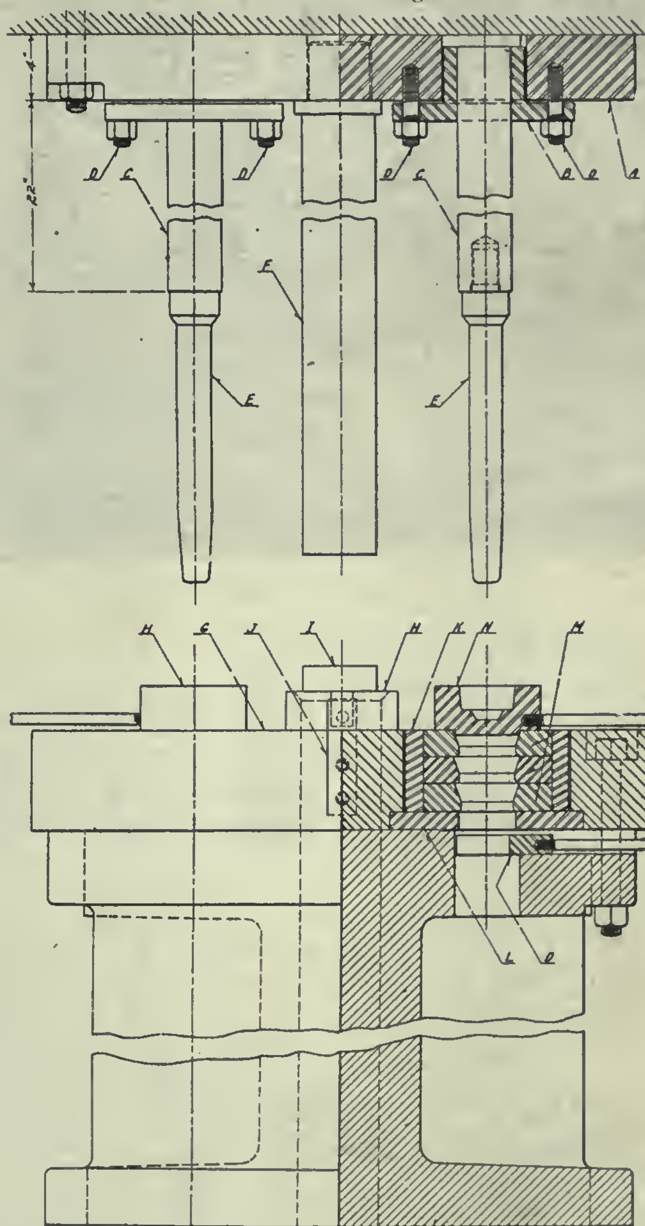


FIG. 7—ASSEMBLY OF TOOLING FOR DRAWING OPERATION.

posts F, one on either side, are used as stops when forming the tit on the end of the forging, and also act as guides when drawing the shells. On the top of the pedestal is secured the plate G that carries the draw rings. When forming the base on the forging the draw plate H with the stop I is moved into position below the posts on the ram, so that the thickness on all the forgings will be the same when the bottoming pan N is resting on the top of the draw rings, as shown in the sketch. The three chills M are held in the retainer ring K, this first reduction being to a diameter of 3.65 inches, the next to a diameter of 3.5 inches, and the final draw leaving the outside diameter 3.4 inches. This gives a wall thickness on the forgings of approximately .612 inch. The general appearance and dimensions of a finished forging are illustrated in the upper half of Fig. 1.

The treatment of the 75 mm. shells after forging is conducted along the same lines as that adopted for the 6 inch forgings, the requirements being practically the same in every respect.

ENGLISH MUNITION JIB CRANE

By P. E. R.

THE electrically operated 4-cwt. jib crane, used in shell factories, as developed by Royce, Limtied, of Trafford Park, Manchester, England, noted in the accompanying illustration, is crane consists of a couple of stout mild steel channels, to which the steel lattice jib of the crane is attached, the mast and the jib being carried on the centre post by two roller bearings, with a suitable top bearing to take the weight. The load is lifted on a single fall of steel

ENGLISH JIB CRANE FOR SHOP USE.

a light type of high speed travelling hoist of recent design.

This crane has the hoisting motion and travelling motion electrically driven, whilst slewing is carried out by hand by pushing or pulling the load. The crane runs on a narrow gauge track, centres of rails being 3 ft. 6 in. and is arranged to pick up current from bare conductors placed in conduit in the centre of the track.

The crane illustrated deals with a 6-cwt. load at a radius of 12 ft. 6 in., the height of jib head pulley being approximately 10 ft. 0 in. above rails. The hoisting speed is approximately 25 feet per minute, while the travelling speed is about 300 ft. per minute and has a factor of 2 to 1 against tipping

It will be observed that the operator's cage or platform is attached to one end of the baseplate and the whole of the control gear, consisting of controllers, resistances, D. P. emergency switch and fuses, is mounted in a convenient position. The hoisting motion is driven by a totally enclosed series wound reversing motor, fitted with a solenoid brake and driving a cast iron machined grooved barrel through machine cut gearing.

The travelling motion is operated by a "Royce" enclosed series wound reversing motor, driving through machine cut gears on to one axle and the two axles being coupled together by means of a Hans-Renold chain. The baseplate of the crane is a massive iron casting, carrying the travelling axle bearings and the centre post of the crane. The mast of the wire rope and the hook is of the swivelling type.

The travelling wheels are of steel, of the single flanged pattern of large diameter, turned on the tread, while the travelling axles are carried in easily renewable brass-bush bearings and the travelling axle nearest the driver's platform is fitted with a powerful brake, operated by means of a foot lever.

PROBLEMS OF MACHINE CONSTRUCTION

By T. H.

Some few weeks ago a paper was read before the American Society of Mechanical Engineers on the subject of "Aeroplane Engine Design." The paper has attracted a good deal of attention in this country by reason both of its acute analysis of the aeroplane engine problem and its extremely well-informed and practical treatment of the subject. But there is another striking feature of the paper which has hardly been commented upon. It deals in a way most unusual in technical papers with the practical mechanical problems that arise in the designing and building of all mechanisms. One example will suffice to show what it meant. The author, Mr. G. E. Lucke, having described the advance from the side-pocket arrangement for the cylinder valves to the valve-in-the-head arrangement, with the advantages accruing from the latter, passes to a consideration of the replacement of the cast iron jacket wall, which has no other function than to hold water, by some lighter arrangement. No sooner is the problem faced than a structural difficulty is at once apparent—the necessity of providing openings for the intake or outlet from each valve, an igniter plug hole, and at least two pipe connections for each jacket, and seatings for certain driving gear fastenings. This, naturally tends towards the retention of a casting as one part of any improved arrangement, and the next step, which though logical enough, took several years to make, was to have the cylinders of cast iron, the head and head jacket in a one-piece casting, and sheet metal for the jacket over the cylinder barrel. Proceeding further along the same line of weight reduction the next step is to cut away this cast iron joining the ends of the parts forming the wall of the head jacket and substituting sheet metal welded to the parts by the oxygen flame, brazing or welding on any additional supports for the attachment of gears. When this is done the cast iron cylinder is still there with its cast iron parts, and there is a fundamental objection to a cast iron cylinder for aeronautical work. Cast iron cylinders need not be very thick to stand the gas pressure stresses provided the metal can be relied upon, but no one can be absolutely sure that the metal inside is good and the use of cast iron cut down to one-eighth inch thick incurs taking chances, hence attention is turned towards steel. Drawn steel or forged steel is reliable, and should be just the material required, but when one comes to study how to use a drawn steel tube for a cylinder and how to get the necessary attachments on it the matter proves not at all simple. That is why the adoption of the steel cylinder was so long delayed. There are now, however several methods of making steel cylinders. There is the steel tube screwed into a separate cast iron head carrying the ports and head jacket cast in one piece; there is an all steel cylinder in which a steel cylinder head is welded to a steel tube body; there is the cylinder made in the form of a drawn-steel shell with head like a cartridge case; there is the Hispano-Suisa arrangement, in which the entire outside of the cylinder is thread and the cylinders are screwed into an aluminum casting which is double-walled just like the cast iron block casting in an automobile engine, and there is finally the one-piece steel forging construction for cylinder, cylinder-head, ports, and ignition holes, surrounded by a steel metal welded jacket. Mr. Lucke discusses the pros and cons of all these arrangements from exactly that standpoint for which the inventor-designer-mechanic may search.

An alloy said to be suitable for springs or polished sheets has been patented by C. L. Jones. The alloy consists of copper, 28 per cent.; nickel, 67.8 per cent.; manganese, 2.5 per cent.; iron, 1.5 per cent., and vanadium, 0.2 per cent.

Metal Workers Will Gather in Milwaukee Oct. 7

Several Association Are Holding Big Gathering, When Matters of Importance Will be Considered—Exhibition of All Sorts of Labor-saving Machinery For Metal Working Will be a Feature

AT Milwaukee, during the week of October 7, will be held the greatest gathering of metal manufacturers ever assembled in this or any other country. Simultaneous meetings will be held by the American Foundrymen's Association, Iron and Steel section of the American Institute of Mining Engineers, Institute of Metals division of the American Institute of Mining Engineers, and American Malleable Castings Association. Concurrent with these meetings will be conducted an exhibition of all kinds of labor saving metal working equipment. Every branch of the metal industries will be represented, including the gray iron, steel, malleable iron and brass foundry trade; iron and steel industry, from the mining of the ore to the production of pig iron, its conversion into steel and finally the rolled product and the brass and copper mill rolling industry.

The keynote of many of the addresses and papers that will be presented will be the acceleration of production for the prosecution and winning of the war. In fact, the purpose underlying the holding of this great meeting is to afford manufacturers of ordnance and other war equipment an opportunity for an interchange of ideas regarding methods of production and operation.

The great interest that is being manifested in this event is reflected by the large number of reservations for space in the Milwaukee Auditorium, where the exhibition will be held. Already 165 manufacturers have decided to make displays and only a comparatively small amount of space is still available. The indications are that this will be the largest show of its kind ever held in this country.

The manufacturers of Milwaukee already have organized committees on arrangements for the entertainment and reception of the visitors who will number from 3,500 to 4,000. The program, although not definitely outlined, will include a reception and dance at the Milwaukee Auditorium, theater party and boat ride. In addition the visiting ladies will be taken on an automobile sightseeing tour and will be tendered several luncheons. Plant visitation probably will be confined to Thursday and Friday and many notable works in the Milwaukee district will be open for inspection. On Thursday evening, Oct. 10, the banquet will be held and addresses will be delivered by speakers of international fame. The Milwaukee committees on arrangements are constituted as follows:

General Committee

Theo. O. Vilter, chairman, president, Vilter Mfg. Co.; W. J. Fairbairn, secretary, Milwaukee Metal Trades and Founders' Association; A. Harrison, superintendent foundry and pattern shop, Allis-Chalmers Mfg. Co.; E. Bearman, Illinois Steel Co.; John D. Bird, general manager, Power & Mining Machinery Co., Cudahy, Wis.; James Marshall, general manager, Geo. H. Smith Steel Castings Co.; W. G. Bruce, secretary, Milwaukee Association of Commerce; Henry Weber, chairman, Milwaukee park board; Geo. Kuemmerlein, superintendent of transportation, Milwaukee Electric Railway & Light Co.; A. E. Copeland, manager, Hotel Wisconsin; W. P. O'Connor, general agent, Goodrich Transportation Co.; F. C. Reynolds, general agent, Pere Marquette railroad, and Jos. C. Grieb, manager, Milwaukee auditorium.

Finance Committee

Theo. O. Vilter, chairman, Vilter Mfg. Co.; W. G. Bruce, Milwaukee Association of Commerce; C. R. Messinger, Chain Belt Co.; J. D. Bird, Power & Mining Machinery Co., Cudahy, Wis.; T. A. Glasscott, Pickands, Brown & Co.; John Thomas, Thomas Furnace Co.; A. J. Lindeman, Lindeman & Hoverson Co.; Otto H. Falk, Allis-Chalmers Mfg. Co., and Walter Kasten, treasurer, finance committee, Wisconsin National Bank.

Entertainment Committee

Geo. Kuemmerlein, chairman, Milwaukee Electric Railway & Light Co.; Henry Weber, Milwaukee park board; J. J. McDevitt, S. Obermayer Co.; John Mertes, Federal Foundry Supply Co.; C. E. Lemmon, chemist; T. A. Glasscott, Pickands, Brown & Co.; James Marshall, Geo. H. Smith Steel Castings Co.; F. C. Reynolds, Pere Marquette railroad, and J. S. Pinson, Avery Co.

Golf Committee

J. D. Bird, chairman, Power & Mining Machinery Co., Cudahy, Wis.; C. R. Messinger, Chain Belt Co.; David McLain, McLain's System; F. E. Layman, chemist, and C. G. Ocock, Avery Co.

Reception Committee

E. Bearman, chairman, Illinois Steel Co.; Frank Cleveland, Milwaukee Association of Commerce; David McLain, McLain's System; J. D. Shaw, Shaw Foundry Co.; E. A. Wurcester, Falk Co.; J. A. McDevitt, S. Obermayer Co.; Henry R. Donald, Essley Machinery Co.; T. A. Glasscott, Pickands, Brown & Co.; O. B. Puplkofer, American Gum Products Co.; W. J. Fairbairn, Milwaukee Metal Trades & Founders' association; Roy Smith, Hotel Pfister; A. E. Copeland, Hotel Wisconsin; Henry Wehr, Wehr Steel Castings Co.; Herman Kletzsch, Republican House; W. W. Sommers, Hotel Carlton; W. M. Nefzger, Hotel

THE AUDITORIUM AT MILWAUKEE WHERE THE CONVENTION OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION AND THE AMERICAN INSTITUTE OF METALS WILL BE HELD DURING THE WEEK OF OCT. 7, 1918.

Schiltz; S. Duffy, Hotel Plankinton, and F. B. Sweeney, Hotel Maryland.

Plant Visitation Committee

A. Harrison, chairman, Allis-Chalmers Mfg. Co.; James Marshall, Geo. H. Smith Steel Casting Co.; H. R. Donald, Essley Machinery Co.; Wells K. Greg and H.G. Siefert.

Banquet Committee

W. P. O'Connor, chairman, Goodrich Transportation Co.; A. E. Copeland, Hotel Wisconsin, and H. Weber, Milwaukee Park Board.

Theatre, Automobile and Boat Excursion Committee

James Marshall, chairman, Geo. H. Smith Steel Casting Co., and J. C. McDevitt, S. Obermayer Co.

Ladies' Committee

E. E. Copeland, chairman, Hotel Wisconsin; F. C. Reynolds, Pere Marquette railroad; Henry Weber, Milwaukee park board and O. B. Puplkofer, American Gum Products Co.

CITY HALL, MILWAUKEE.

GRAND AVE., LOOKING EAST.

The meetings of the Allied Metal Trades Association will be opened on Tuesday morning, Oct. 8, with a joint session at which the address of welcome will be delivered by Emanuel L. Phillip, governor of Wisconsin. This will be followed by addresses relating to the importance of the metal working industry in the prosecution of the war by speakers of note who are familiar with the activities at Washington. Upon adjournment, the opening session of the American Foundrymen's Association, Iron and Steel section, and the Institute of Metals division of the American Institute of Mining Engineers will be called to order in separate halls in the Milwaukee Auditorium where the activities of the week will be centered.

Will Use Moving Pictures

The exhibition will be opened formally on Monday afternoon, Oct. 7. Beginning Tuesday, Oct. 8, the American Foundrymen's Association will hold daily meetings in the morning only, and on several days simultaneous sessions will be necessary to dispose of the lengthy program in time for adjournment Friday noon, Oct. 11. The Institute of Metals division of the American Institute of Mining Engineers will have one meeting on Tuesday, two on Wednesday, and one on Thursday. The Iron and Steel section of the American Institute of Mining Engineers will hold three meetings and will adjourn Wednesday afternoon. Only one meeting is scheduled by the American Malleable Castings Association.

One of the notable features of these meetings will be the large number of interesting moving pictures that will be shown. These will include the use and manufacture of hand grenades; the civil re-establishment of wounded and crippled Canadian soldiers; the manufacture and launching of ships at the Hog Island yard, Philadelphia; the building of concrete ships; the manufacture of steel by the triplex process, and the cause and prevention of industrial accidents.

The program of the American Foundrymen's Association includes a large number of papers of interest to manufacturers of gray iron, steel and malleable castings. To dispose of the program in the time alloted, separate sessions will be held for the consideration of papers relating to gray iron, steel and malleable iron foundry practice. An accident prevention conference also is scheduled at which a large number of papers will be presented and addresses delivered on the conservation of life and limb in industrial plants.

The Program of Events

A tentative program of the topics that will be discussed follows:

"Sand-Blasting Equipment," by C. T. Bird, Pangborn Corp., Hagerstown, Md.

"Engineers—Their Relation to the Foundry in the Saving of Labor," by E. S. Carman, Cleveland Osborn Mfg. Co., Cleveland.

"Pouring Devices," by Mark P. Ohlsen, Brillion Iron Works, Brillion, Wis.

"Effective Means of Improving the Quality of Sand Mixtures," by H. B. Hanley, New London Ship & Engine Co., Groton, Conn.

"Common Troubles in Cupola Practice Which Tend to Cut Down Production," by G. S. Fisher, Whiting Foundry Equipment Co., Harvey, Ill.

"Women in Foundries," by C. E. Knoeppel, C. E. Knoeppel & Co., New York.

"Organizing a Foundry for Tractor Production," by Paul M. Ramp, Moline, Ill.

"Coke Problems of the Foundryman," by J. A. Galligan, Pickands, Brown & Co., Chicago.

"Recent Developments in Burning Oil in Cupolas," by John Howe Hall, Taylor-Wharton Iron & Steel Co., High Bridge, N.J.

"Continuous Operation of a Two-Storey Foundry," by J. F. Ervin, Michigan Motor Castings Co., Flint, Mich.

"Sale and Distribution of Foundry Pig Iron in War Times," by C. J. Stark, editor the "Iron Trade Review," Cleveland.

"Concrete Foundry Floors," by George Moyer, Textile Machine Works, Reading, Pa.

"Training Your Own Help Instead of Competing With Other Manufacturers," by Ernest Van Billiard and T. Hough, Jr., General Railway Signal Co., Rochester, N.Y.

"Blowers," by J. Trinks, Pittsburgh.

"Precipitation of Dust in Foundries," by H. D. Egbut, Research Corp., New York.

"Pyrometers and Their Application to Core Ovens," by J. P. Goheen, Brown Instrument Co., Philadelphia.

"Cast Iron in Service Projectiles and Trench Warfare," by Major Edgar Allen Custer, Pittsburgh district ordnance department, Pittsburgh.

Moving picture film on the "Manufacture and

Use of Hand Grenades," by Major Frank B. Gilbreth, Providence, R.I.

"A Rapid Method for the Determination of Graphitic Carbon," by Frank H. Kingdom, Metallurgist, Sullivan Machinery Co., Claremont, N.J.

"Cores in the Foundry," by Walter F. Prince, Elizabeth, N.J.

Malleable Iron Foundry Practice

"Some Features of Malleable Iron Practice," by J. G. Garrard, Northwestern Malleable Iron Co., Milwaukee.

"Soundness," by Enrique Touceda, Albany, N.Y.

"Annealing Malleable Iron," by H. E. Diller, General Electric Co., Erie, Pa.

"Use of Malleable Castings," by H. A. Schwartz, National Malleable Castings Co., Indianapolis.

"White Rim or Picture Frame Fractures," by J. B. Deisher, T. H. Symington Co., Rochester, N.Y.

"Advantages of Malleable Iron versus Steel for Agricultural Castings," by W. A. Forbes, Rockford Malleable Iron Co., Rockford, Ill.

"The Symington Core Department," by Donald S. Barrows, T. H. Symmington Co., Rochester, N.Y.

Accident Prevention Conference

"The Cause and Prevention of Industrial Accidents," to be shown by moving pictures and illustrating accidents as reported to the Industrial commission of Ohio.

"Accident Prevention is Good Business," by Hon. Fred M. Wilcox, vice-president Wisconsin industrial commission.

"What the State Can Do to Prevent Accidents," by Hon. Thomas J. Duffy, chairman, Industrial commission of Ohio.

"What the Buckeye Steel Castings Co. Has Accomplished in Accident Prevention," by Fred G. Bennett, safety director, Buckeye Steel Castings Co., Columbus, O.

"The Importance of Organization in Accident Prevention," by C. W. Price, field secretary, National safety council, Chicago.

"The Vital Necessity of Conserving Man Power During the War," by Victor T. Noonan, safety director, Industrial Commission of Ohio, Columbus, O.

"What Shall be Done with the Crippled Soldier," by W. A. Janssen, vice-president, Canadian Steel Foundries, Montreal, Canada.

Steel Foundry Practice

"Ordnance Steel for the Army and Navy," by John Howe Hall, Taylor Wharton Iron & Steel Co., High Bridge, N.J.

"Operating an Electric Furnace for the Production of Ordnance Castings," by W. E. Moore, Union Bank building, Pittsburgh.

"Steel Foundry Practice in the Far West," by J. D. Fenstermacher, Columbia Steel Co., San Francisco.

"Acid versus Basic Lining for Electric Furnaces," by F. J. Ryan, Electric Furnace Construction Co., Philadelphia.

An interesting report on the heat treatment of steels Nos. 2 and 3, specified by the ordnance departments also will be submitted. This will be followed by a topical discussion of the manufacture of steel for ordnance purposes by foundrymen who have had a wide experience in this work.

The program of the Institute of Metals division of the American Institute of Mining Engineers is replete with practical topics of interest to the brass foundryman. One feature of this gathering will be the discussion of the conservation of tin and representatives of various industries using tin in manufacture will contribute to this symposium.

Tuesday Morning, Oct. 8

"The Metallography of Tungsten," by Zay Jeffries.

"The Constitution of the Tin Bronzes," by S. L. Hoyt.

"Notes on Babbitt and Babbitted Bearings," by Jesse L. Jones.

"Oxygen and Sulphur in the Melting of Copper Cathodes," by S. Skowrouski.

"The Relation of Sulphur to the Overpoling of Copper," by S. Skowrouski, with discussion by Philip L. Gill.

Wednesday Morning, Oct. 9

Symposium on "The Conservation of Tin." This topic will be discussed by the following:

G. W. Thompson, National Lead Co.
G. H. Clamer, Ajax Metal Co., Philadelphia.
C. M. Waring, Pennsylvania Railroad Co.
M. L. Lissberger, Mark Lissberger & Son, Inc., Long Island City, N.Y.
D. M. Buck, American Sheet & Tin Plate Co., Pittsburgh.
W. M. Corse, Buffalo.
G. K. Burgess and Mr. Woodward, United States bureau of standards, Washington, D.C.
M. L. Dizer, war industries board, Washington, D.C.

The first session of the iron and steel section of the American Institute of Mining Engineers will be devoted to the consideration of papers on iron and steel topics. This will include the consideration of iron ores, ferro alloys, silica brick and the manufacture of steel. Another meeting will consider coal and coke. The program tentatively outlined follows:

SESSION ON IRON AND STEEL

Tuesday Morning, Oct. 8

"The Limonite Deposits of Mayaguez Mesa, Porto Rico," by C. R. Fettke and Bela Hubbard.

"The Manufacture of Ferro-Alloys in the Electric Furnace," by R. M. Keeney.

"The Manufacture of Silica Brick," by H. Le Chatelier and B. Bogitch.

"Notes on Some Iron Ore Resources of the World."

"Recent Geologic Developments on the Mesabi Iron Range," discussion by Anson A. Betts and J. F. Wolff.

"A Volute Ageing Break," by Henry M. Howe.

Moving Pictures of the Triplex Steel Process.

SESSION ON COAL AND COKE

Wednesday Morning, Oct. 9

"The By-product Coke Oven and Its Products," by W. H. Blauvelt.

"The Use of Coal in Pulverized Form," by H. R. Collins.

"Carbocoal," by C. T. Malcolmson.

"Low-tempered Distillation of Illinois and Indiana Coals," by G. W. Traer.

"Price Fixing of Bituminous Coal by the United States Fuel Administration," by R. V. Norris and others.

MISCELLANEOUS SUBJECTS

Wednesday Afternoon, Oct. 9

Moving pictures showing the construction of concrete ships.

Moving pictures showing the civil re-establishment of crippled soldiers in Canada.

The exhibition of all kinds of labor saving equipment to be held in the Milwaukee Auditorium, both in size and number of individual exhibits, probably eclipses anything of its kind ever held. Machinery hall will be converted into a foundry and machine shop since practically all of the equipment to be displayed in this section of the auditorium will be operated. Many new devices will be shown which have been designed and built to facilitate the production of materials for the winning of the war. Exhibits will be made by the following manufacturers:

Abell-Howe Co., Chicago.
Abrasive Co., Philadelphia.
Allis-Chalmers Mfg. Co., Milwaukee.
American Gum Products Co., New York.
American Foundry Equipment Co., Cleveland.
American Kron Scale Co., New York.
E. C. Atkins & Co., Indianapolis.
Arcade Mfg. Co., Freeport, Ill.
Asbury Graphite Mills, Asbury, N.J.
Austin Co., Cleveland.
Ayer, Lord & Tie Co., Chicago.
Badger-Packard Machinery Co., Milwaukee.
Barrett Co., Chicago.
Beaudry & Co., Boston.
Berkshire Mfg. Co., Cleveland.
S. Birkenstein & Sons, Chicago.
G. S. Blodgett Co., Burlington, Vt.
Blystone Mfg. Co., Cambridge Springs, Pa.
Brass World Publishing Co., New York.
Bristol Machine Tool Co., Bristol, Conn.
Brown Specialty Machinery Co., Chicago.
Buckeye Products Co., Cincinnati.
Bullard Machine Tool Co., Bridgeport, Conn.
Carborundum Co., Niagara Falls, N.Y.
Central Electric Co., Chicago.
Champion Foundry & Machine Co., Chicago.
Frank D. Chase, Chicago.
Chard Lathe Co., New Castle, Ind.
Charles J. Clark, Chicago.
Cincinnati Pulley Machinery Co., Cincinnati.
Cleveland Osborn Mfg. Co., Cleveland.
Cleveland Pneumatic Tool Co., Cleveland.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Thomas E. Coale Lumber Co., Philadelphia.
Combined Supply & Equipment Co., Buffalo.
Corn Products Refining Co., Chicago.
"Daily Iron Trade and Metal Market Report," Cleveland.
Dale-Brewster Machinery Co., Chicago.
Davenport Machine & Foundry Co., Davenport, Iowa.
Davis-Bournonville Co., Chicago.
Dayton Moulding Machine Co., Dayton, O.
Deister Concentrator Co., Ft. Wayne, Ind.
Detroit Drill Co., Detroit.
Detroit Steel Products Co., Detroit, Mich.
Dings Magnetic Separator Co., Milwaukee.
Joseph Dixon Crucible Co., Chicago.
R. E. Ellis Engineering Co., Chicago.
Erwin Mfg. Co., Milwaukee.
Federal Foundry Supply Co., Cleveland.

LEIF ERICSON MONUMENT IN JUNEAU PARK, MILWAUKEE. IT IS CLAIMED FOR HIM THAT HE WAS THE FIRST TO DISCOVER AMERICA.

Foreign Crucibles Co., New York.
"The Foundry," Cleveland.
Foundry Appliance Co., Newark, N.J.
Foundry Equipment Co., Cleveland.
Foundrymen's Supply Co., Milwaukee.
Warren F. Fraser Co., Westboro, Mass.
Garden City Sand Co., Chicago.
General Electric Co., Schenectady, N.Y.
General Steel Co., Milwaukee.
Gooley & Edlund, Cortland, N.Y.
Gordon Sand Co., Conneaut, O.
Great Western Mfg. Co., Leavenworth, Kansas.
Norma Co. of America, New York.
Norton Co., Worcester, Mass.
Oakley Machine Tool Co., Cincinnati.
S. Obermeyer Co., Chicago.
Oesterlein Machine Co., Cincinnati.
Ohio Machine Tool Co., Kenton, O.
Oliver Machinery Co., Grand Rapids, Mich.
Oxyweld Acetylene Co., Chicago.
Pangborn Corp., Hagerstown, Md.
Pawling & Harnischfeger Co., Milwaukee.
Peerless Machine Co., Racine, Wis.
Peck Iron & Steel Works, Kalamazoo, Mich.
Sand Mixing Machine Co., New York.
Schroeter Engineering Co., Chicago.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Simonds Mfg. Co., Fitchburg, Mass.
W. W. Sly Mfg. Co., Cleveland.
R. P. Smith & Sons Co., Chicago.
Werner G. Smith Co., Cleveland.
Southworth Machine Tool Co., Portland, Me.
Standard Optical Co., Geneva, N.Y.
The Standard Sand & Machine Co., Cleveland.
Sterling Wheelbarrow Co., Milwaukee.
Frederic B. Stevens, Detroit.
W. F. Stodder, Syracuse, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Sullivan Machinery Co., Chicago.
Swan & Finch Co., Chicago.
Thomas Elevator Co., Chicago.
Torchweld Equipment Co., Chicago.
United Compound Co., Buffalo.
United States Graphite Co., Saginaw, Mich.
U.S. Molding Machine Co., Cleveland.
U.S. Smelting Furnace Co., Belleville, Ill.
United States Silica Co., Chicago.
Wadsworth Core Machine & Equipment Co., Akron, O.
J. D. Wallace & Co., Chicago.
Warner & Swasey Co., Cleveland.
Western Electric Co., New York.
F. H. Wheeler Mfg. Co., Chicago.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Detroit.
Young Bros. Co., Detroit.

LAKE PARK.—MILWAUKEE IS FAMOUS FOR ITS WONDERFUL PARK SYSTEM—NO PART OF THE CITY IS MORE THAN WALKING DISTANCE FROM SOME PARK.

SAVE TO WIN

At a time when strong measures are being taken to gather together scrap metal and old rags it occasions no surprise to find a campaign launched for the eliminating of waste in the spending of money. The country needs every dollar that can be saved, and every movement that will promote this end merits encouragement. A great deal is said about the value of the last dollar in this struggle, but the lavishness with which some people spend money would almost incline one to think that the dollar was not of much importance. But it is, and every quarter dollar, too. The larger the number of those who save, the more enduring will be the foundations of our financial and industrial edifice.

Edith M. Thayer, in "Popular Mechanics," says: "Used carbon or transfer paper can be made to last much longer by simply holding it over an open flame such as a lamp, candle, or match, with the carbon side down. The wax substance of the unused parts will melt and run into the thinner sections of the used parts."

Greaves-Klusman Tool Co., Cincinnati.
Grimes Molding Machine Co., Detroit.
Hauck Mfg. Co., Brooklyn, N.Y.
Hausfield Co., Harrison, O.
Hayward Co., New York.
Henry & Wright Mfg. Co., Hartford, Conn.
Herman Pneumatic Machine Co., Pittsburgh.
Hoevel Mfg. Corp., New York.
Holcomb Safety Garment Co., Chicago.
Holland Core Oil Co., Chicago.
Hyatt Roller Bearing Co., New York.
Imperial Brass Mfg. Co., Chicago.
Industrial Molding Machine Co., Chicago.
"The Iron Age," New York.
"The Iron Trade Review," Cleveland.
Jennison-Wright Co., Toledo, O.
Chas. Jurack Pattern Works, Milwaukee.
C. C. Kawin Co., Chicago.
Kearney & Trecker Co., Milwaukee.
Spencer, Kellogg & Sons, Buffalo.
Kempsmith Mfg. Co., Milwaukee.
Julius King Optical Co., Chicago.
Laclede-Christy Clay Products Co., St. Louis.
H. M. Lane Co., Detroit.
Loewenthal Co., Chicago.
Lees Bradner Co., Cleveland.
David Lupton's Sons Co., Philadelphia.
Marshall & Huschart Machinery Co., Chicago.
McCrosky Reamer Co., Meadville, Pa.
McLain's System, Milwaukee.
McLain Carter Furnace Co., Milwaukee.
Mueller Machine Tool Co., Cincinnati.
MacLean Publishing Co., Toronto, Ont.
Macleod Co., Cincinnati.
Magnetic Mfg. Co., Milwaukee.
Mahr Mfg. Co., Minneapolis.
Marden, Orth & Hastings Corp., New York.
"Metal Industry," New York.
Metal & Thermit Corp., New York.
Modern Tool Co., Erie, Pa.
Monarch Engineering & Mfg. Co., Baltimore.
Mumford Molding Machine Co., Chicago.
Monroe Calculating Machine Co., New York.
Napier Saw Works, Springfield, Mass.
National Engineering Co., Chicago.
New Chicago Crucible Co., Chicago.
Wm. H. Nicholls Co., Brooklyn, N.Y.
Penton Publishing Co., Cleveland.
George F. Pettinos, Philadelphia.
Phoenix Mfg. Co., Eau Claire, Wis.
Picklands, Brown & Co., Chicago.
Pittsburgh Furnace Co., Milwaukee.
Portage Silica Co., Youngstown, O.
Henry E. Pridmore, Chicago.
Progressive Metal & Refining Co., Milwaukee.
Quigley Furnace Specialties Co., New York.
Racine Tool & Machine Co., Racine, Wis.
Richards-Wilcox Mfg. Co., Aurora, Ill.
Rivett Lathe & Grinder Co., Boston.
Robeson Process Co., New York.
Rogers, Brown & Co., Cincinnati.

PLANT OF THE KEMPSMITH MANUFACTURING CO., MILWAUKEE.

A NOVEL TENSION AND COMPRESSION TESTING INSTRUMENT

By FRANK C. PERKINS

THE accompanying illustrations, Figs. 1, 2, 3 and 4 and drawing Figs. 5 and 6, show a unique form of extension and compression instrument recently described in a paper before the American Society for testing materials and load deformation diagrams and curves of tests made with this instrument. Its applicability to a wide range of specimen sizes, either for tension or compression, was pointed out as well as the ease of use with a satisfactory degree of accuracy and its simple construction and low cost.

It is stated by Prof. S. H. Graf, of the School of Engineering and Mechanic Arts of the Oregon Agricultural College at Corvallis, Oregon, that the device combines in one instrument all the requirements usually met less satisfactorily by several extensometers and compressometers. This universal strainometer is of simple design and consists of two simple adjustable frames, each carrying two screws bearing on the gage marks on the specimen. One of the frames carries an Ames dial and pivots on a rod held rigidly in the other frame, the dial indicating twice the actual deformation.

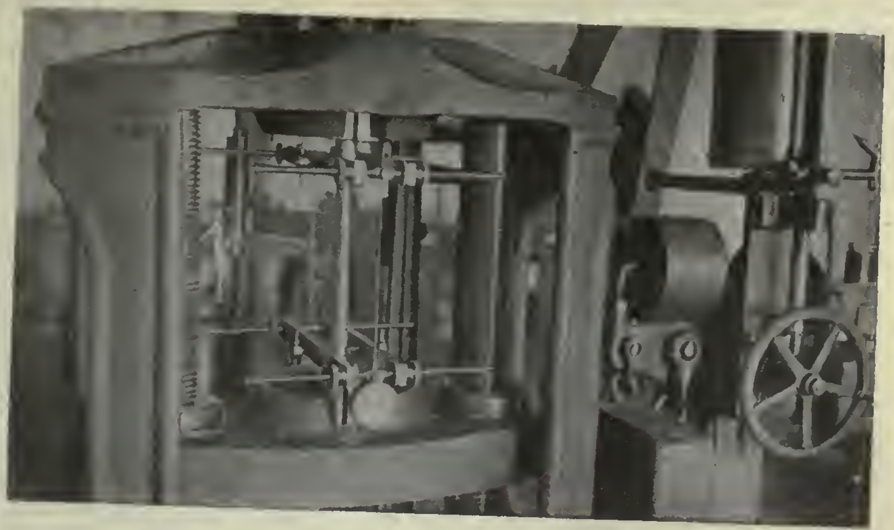


FIG. 2. EXTENSOMETER IN PLACE ON TENSILE TEST PIECE.

FIG. 1.

A toggle clamp prevents the frame from separating from the pivot, and a slender steel rod actuates the staff of the gag head. The error due to tilting of the dial from within the range of any test is of no consequence and within the elastic limit it is not a redable quantity.

The photographs, Figs. 2, 3 and 4, show the instrument applied to various specimens and indicate its range; this range includes specimens either in tension or compression up to 8 in. in diameter or square, and of any gage length from 2 in. up. To adapt the instrument to different gage lengths, for the ordinary lengths of specimens, rods of drill steel, 1-8 and 1-16 in. in diameter, respectively, are suitable, while for special tests where the length may be considerable, light wooden strips with steel inserts in the ends are perhaps most satisfactory.

The accuracy and reliability of the Ames dial when applied to strain measurements has been well established as repeated calibrations of the complete strainometer as just described, both

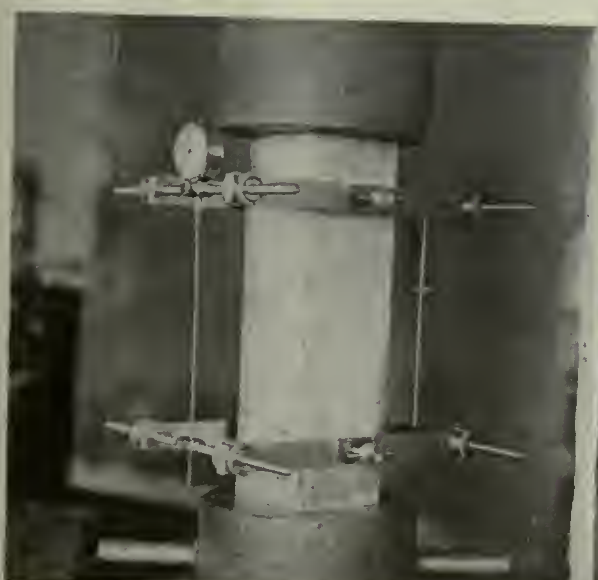


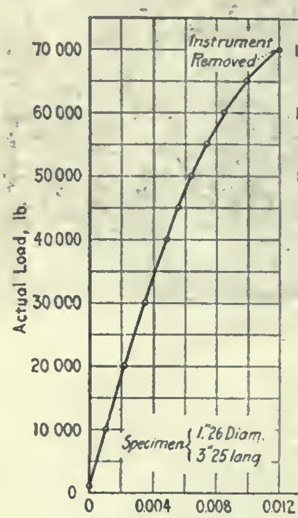
FIG. 4. APPLICATION TO COMPRESSION TEST OF WOOD.

FIG. 3.

against a micrometer and against test bars of known modulus, have shown the instrument to be fully as accurate as others designed to read the 0.0001 in. Some of the extensometers and compressometers on the market, while fundamentally of very precise design, are so complicated and cumbersome as well as slow and difficult to read, that their apparent accuracy as shown by calibration cannot be obtained under operating conditions.

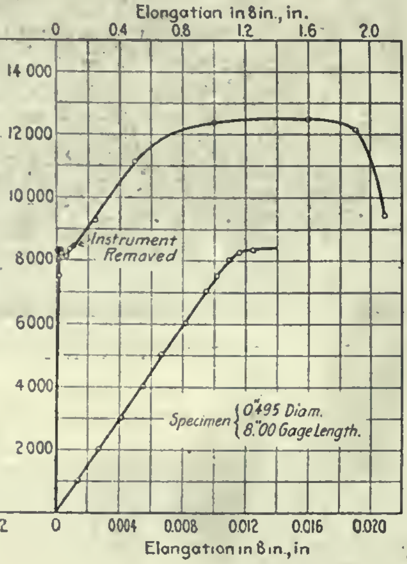
Some objection has been made to instruments having only two instead of three points of attachment, but numerous studies made by means of the Berry strain gage on the distribution of stress in various specimens under test have convinced the author that under proper conditions of gripping tension specimens and of bedding compression specimens, the two point instrument will, with equal care in centering, give the average deformation as faithfully as the other.

If provided with three dials or micrometers the three point instrument is useful in showing roughly the distribution of stress, but this makes the instrument too complicated for all ordinary purposes. Three observers would be required if readings were to be taken on the run, and even when load is applied by increments, it is difficult for a single observer to read three dials or micrometers accurately. It will be seen that this strainometer embodies a combination of principles previously applied in various other instruments and is of great value in experimental work where the extensometer and compressometer have been utilized in the past.



Compression Test of Cast Iron

FIG. 5.



Tension Test of Mild Steel.

FIG. 6.

On August 29 the United States government paid out $156,000,000 for ordinary war expenses, making the largest single day's expenditures for these expenses in the nation's history.

TORONTO SECTION HAD GOOD DISCUSSION

American Institute of Electrical Engineers Hear Address By Past President

The Toronto section of the American Institute of Electrical Engineers opened its sixteenth season on Friday, Sept. 20th, at the Engineers' Club, with an address by Mr. Paul M. Lincoln of the Westinghouse Electric Manufacturing Company, East Pittsburg, on the subject of Development of Power Transmission.

Mr. Lincoln reviewed the progress of electric power transmission from its inception, and even presented comparisons with prior developments in power transmission by hydraulic, mechanical and pneumatic methods. The record of early transmissions with alternating current at approximately 1,000 volts was especially interesting in view of their effect on the ultimate standardization of alternating current systems with existing voltages as high as 150,000. Mr. Lincoln discussed the limitations to still higher voltages of transmission, and it is his opinion that, within five years, there will be one or more systems operating at 200,000 volts.

As is common with meetings of the Toronto Section, there was a great deal of very interesting discussion of the paper. Mr. Murphy, of the Department of Railways and Canals, related some interesting experiences in connection with early electrical developments in Ottawa, with particular reference to his experience with one of the first synchroscopes; an early invention of Mr. Lincoln's. The paper was also discussed by Messrs. F. G. Clark, H. C. Don Carlos, D. H. McDougell, P. E. Hart, W. F. Dobson, E. B. Dwight, E. V. Pennell and others.

Mr. Lincoln was tendered a very enthusiastic vote of thanks on behalf of the seventy members present at the meeting.

The next meeting of the local section on Octobr 4th will continue the discussion of Power Transmission to present day problems, as a general discussion is scheduled on the subject of Grounded Neutral versus Isolated Systems of High Tension Transmission and Distribution.

Mr. A. H. Hull, chairman of the Section, announced that in November an official meeting of the Institute would be held in Toronto, at which the president and directors would attend from New York. At this meeting there will be three or more papers presented by Canadian members of the Institute, all dealing with developments of the electrical art in Canada.

NINE MONTHS FOR LETTER FROM RUSSIA

Harmless Epistle Had Quite a Time Getting Through To This Country

There are evidences coming to the surface frequently now of the condition of affairs that existed in Russia during the last few months. There are many Canadian firms who have wondered at times what has become of mail matter that they were expecting from that much worried country.

A letter came to the office of CANADIAN MACHINERY this week from G. Talal, a machinery dealer at Odessa, Russia. Translated it reads:

Gentlemen:—

In reply to your favor of 17th August, 1917, I have the pleasure of informing you that I shall be happy to receive your new "Annual Review Number," which, without doubt, will be very useful to me as I interest myself specially in the industry of your country.

Awaiting the prompt arrival of your publication as well as the pleasure of hearing from you, I present you my compliments,

G. TALAL.

The letter was started on its journey on the 10th of December, 1917, and reached this office on the 13th of September, 1918. It also bears the mark of having been opened by the censor.

British sinkings in eight months of the present year total 1,681,686 tons. Completions total only 1,029,865 tons. Thus the British merchant fleet is steadily shrinking in size, while the Japanese is greatly increasing. At the end of the last great war Britain possessed a larger mercantile marine than at any previous period in her history, and thus it was comparatively easy to make good the ravages of war by drawing upon all the markets of the world. There is no such prospect as things are now tending, yet ships will again be the first requisite when reconstruction begins.

Causes of Failure in Boiler Plates

Effect of Grain Growth—Alteration of Crystalline Structure by Mechanical Deformation—Some Remedies

By WALTER ROSENHAIN and D. HANSEN.

THE occasional cases of failures in boiler plates met with in practice have formed the subject of several papers and discussions before the Iron and Steel Institute in recent years. A number of such cases have been investigated by the authors, and an account of one which offers features of particular importance which do not appear to have been previously noticed was read before the Iron and Steel Institutes in May. These are of special importance because it may be found that they afford a clue to the cause of failure in other cases, particularly in boiler plates of the largest dimensions.

The failure occurred in the last stage of the manufacture of the plate. The size and dimensions of the plate are illustrated in Fig. 1. The plate has a thickness of 1¾ in. and measures 4 ft. 4 in. in width by 11 ft. in length. It was manufactured under a stringent specification, but cracked during the straightening of the edges after the bending operations had been completed. Inquiry showed that the bending operations had been carried out in stages in the cold, the plate being subjected to intermediate annealings between the various stages. The position of the crack which formed in the plate is indicated in the diagram.

The material of the plate was first submitted to chemical analysis, mechanical tests, and general microscopic examination. The results obtained were as follows:

CHEMICAL ANALYSIS

	Per Cent.		Per Cent.
Carbon	0.16	Manganese	0.623
Silicon	0.079	Nickel	0.10
Sulphur	0.030	Chromium	nil
Phosphorous	0.048		

There is nothing abnormal in this composition, which represents a mild steel of high quality.

Tensile tests were taken from the outside and inside of the plate as received, with the results in Table 1, columns 1 and 2:

Here again there is nothing abnormal, except perhaps a slight indication of an unusual condition of the steel in the comparatively large difference between elastic limit and yield stress. It was thought that possibly this peculiarity might arise from the existence of internal stresses in the material, and in order to remove these as far as possible without changing the structural condition of the steel, a portion of the plate was annealed at 550° C. for 30 minutes. The results of tensile tests of a plate in this condition are given in the third column of Table 1. It will be seen that the difference between elastic limit and yield stress is still comparatively large.

In order, further, to test this point, and also to ascertain how far the tensile tests obtained on the material, as received and after annealing at 550° C., correspond to the best properties which the material is capable of attaining, a sample of the plate was normalized by

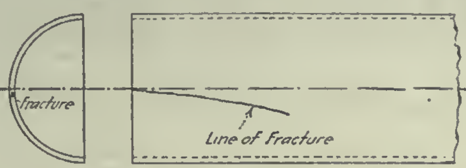


FIG. 1—WHERE THE FRACTURE OCCURRED.

heating to 900° C. followed by cooling in air. The results of tensile tests made on the sample thus treated are given in column 4 of Table 1. Here it will be seen that the elastic limit has come very much closer to the yield stress, while the yield stress itself has been raised. The ultimate stress has only been slightly affected, but, on the other hand the elongation has been markedly improved.

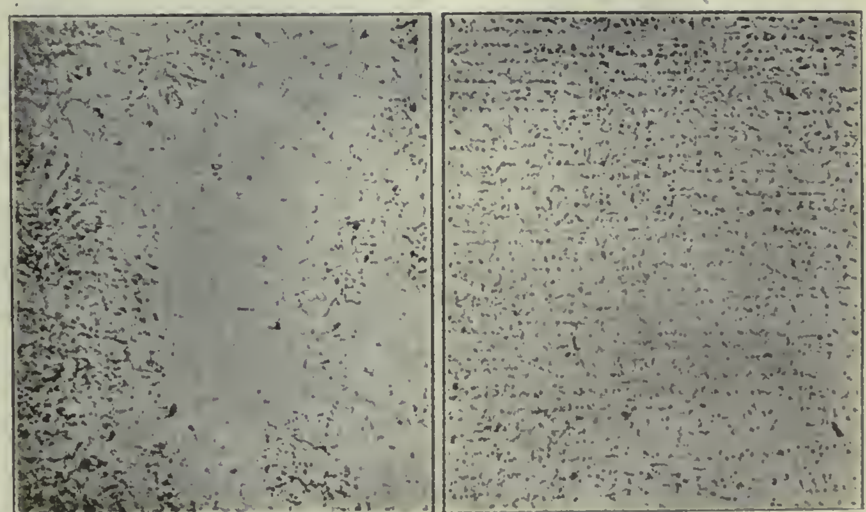
Since the tensile tests showed little or no departure from the normal in the material of this plate it became desirable to apply other tests in order to ascertain whether the properties of the steel were really as satisfactory as the tensile tests would indicate. For this purpose an impact test has been used, for although it is recogized that the conditions under which failure occurs in boiler plate possess no apparent resemblance to those of an impact test, yet experience has repeatedly shown that materials which give a low figure under an impact test are liable to fail under apparently static conditions.

The form of impact test employed is that known as the international notched bar impact test, made with a modification of the Charpy impact testing machine, and on specimens measuring 10 mm. by 10 mm. in section by 53.3 mm. in length, having in the middle a rounded notch with a radius of two-thirds of a millimeter. On the material as received this test gave a mean figure of 0.75 kgm. per sq. cm., the actual values obtained being: 0.84, 0.88, 0.66, 1.08, 0.86, 1.20. These figures are of course very abnormally low, a reasonable value for a boiler plate of this kind being from 8 to 11 kgm. per sq. cm. It was thought that possibly this low value might be

TABLE 1—PHYSICAL TESTS OF THE FAILED PLATE

Particulars.	Plate as Received		Plate Annealed 550° C.	Plate Normalized 900° C.
	Outside 1	Inside 2	Outside 3	Outside 4
Diameter, in.	0.375	0.375	0.375	0.375
Cross sectional area, sq. in.	0.1105	0.1105	0.1105	0.1105
Elastic limit, tons per sq. in.	14.2	11.3	15.4	18.3
Yield stress, tons per sq. in.	18.3	16.1	18.7	19.15
Ultimate stress, tons per sq. in.	26.88	27.24	27.61	27.94
Modules, lb. per sq. in.	29.8×10^6	29.8×10^6	30.4×10^6	30.2×10^6
Extension per cent. on 1.3 in.*	31.6	33.1	34.5	42.2
Reduction of area per cent.	59.6	60.7	59.1	62.5

*A gage length of 1.3 in. is chosen to give a ratio of gage length to diameter equal to 3.5.



FIGS. 2 AND 3—STRUCTURE IN TRANSVERSE AND LONGITUDINAL SECTION OF THE ORIGINAL METAL, 50 DIAMETERS. A CONSIDERABLE AMOUNT OF BANDING IS PRESENT.

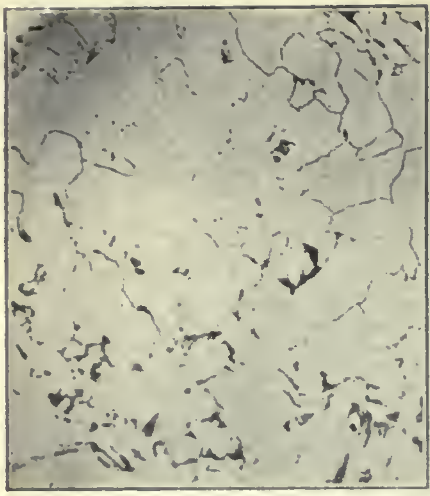


FIG. 4 (LEFT) LARGE FERRITE CRYSTALS IN THE CARBONLESS BENDS OF THE STRUCTURE AFTER FURTHER ETCHING; MAGNIFICATION IS 150 DIAM.

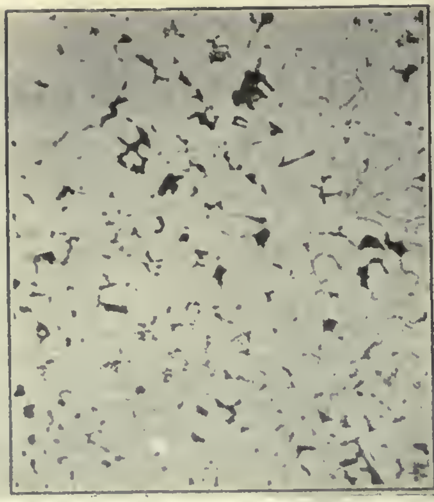


FIG. 5 (CENTRE)—SAME MATERIAL AFTER NORMALIZING; MAG. 150 DIAM.

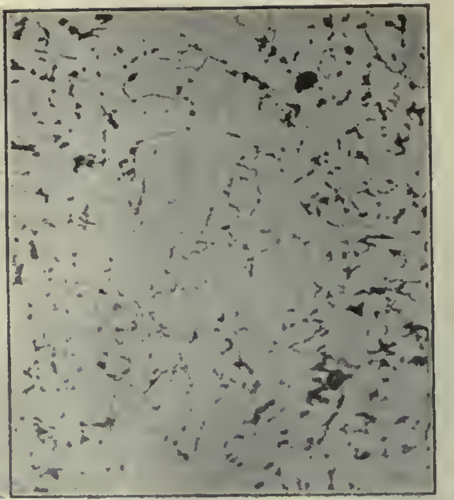


FIG. 6 (RIGHT)—STRUCTURE OF ONE OF CARBONLESS AREAS OF THE SPECIMEN WHICH HAS BEEN HAMMERED IN THE [illegible] AND THEN ANNEALED AT 650° C. MAG. 150.

due to cold work which the plate had received, leaving it in a work-hardened and, possibly, internally strained condition. The impact tests were therefore repeated on specimens of the plate which had been annealed for thirty minutes at 550° C., in the same way as had been done with the tensile test pieces. The mean result of six impact tests made on the steel in this condition gives a value of 2.90 kgm. per sq. cm., the actual figures obtained being as follows: 2.10, 3.86, 2.64, 3.36, 3.52, 1.92.

It will be seen that this very low temperature annealing, by removing cold work and internal stress has improved the impact behaviour of the material quite appreciably, but that, even when thus treated, it is still very far below the normal value for steel of this grade. This is indicated by the impact figures given on samples of the plate after normalizing at 900° C., when values of 10.78 and 11.72—mean, 11.25 kgm. per sq. cm. were obtained.

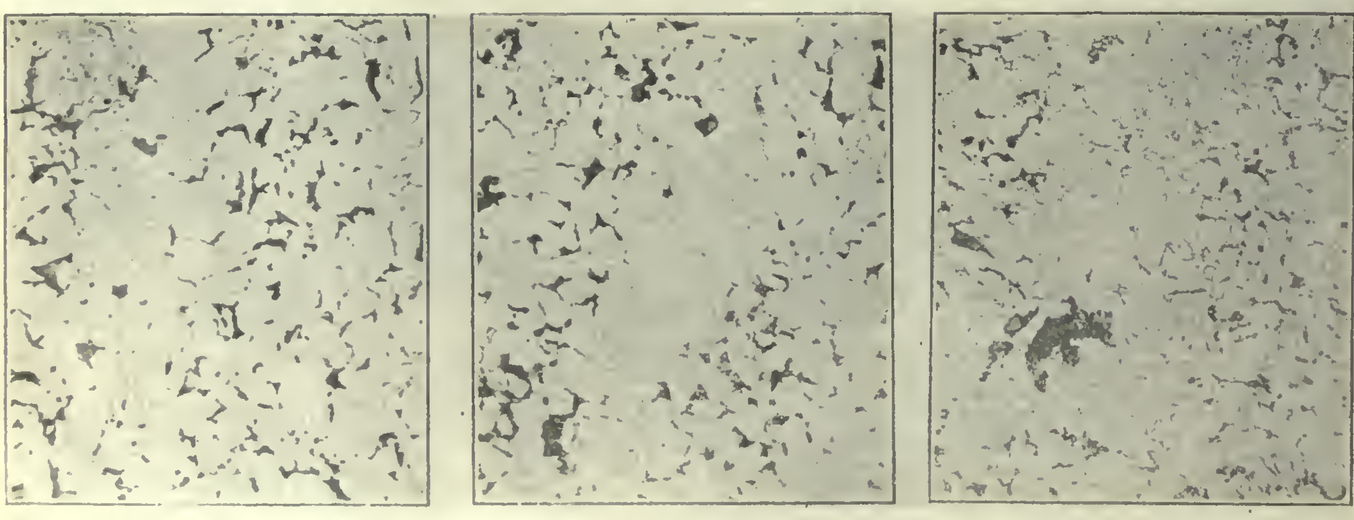
It is evident from these figures that the steel of the fractured plate is in an abnormally bad condition, presumably as the result of some treatment—thermal or mechanical, or both—which it has received during manufacture, and it became necessary to discover, if possible, the cause of this abnormality.

The general microscopic examination of the steel showed at first sight nothing abnormal. The structure in general transverse and longitudinal section is shown under a magnification of 50 diameters in photomicrographs Figs. 2 and 3. It will be seen that the scale of the structure, so far as ferrite-pearlite distribution is concerned, appears to be satisfactory, but there is a considerable amount of banding present, although this amount is not in itself abnormal for a plate of such large size.

More careful examination of the structure, however, particularly after it had been etched in such a way as to develop the ferrite boundaries, revealed a striking pecularity. This takes the form of relatively very large ferrite crystals in the carbonless bands of the structure. These are illustrated, under a magnification of 150 diameters, in Fig. 4. The corresponding grain size of the same material, after normalizing, is shown in Fig. 5 under the same magnification. It should be noted, however, that the normalized structure shown in Fig. 5 has been obtained not by treating a small laboratory sample but from a comparatively large piece of the plate about a foot square which had been subjected to the heat treatment described. The most careful study of the steel in both conditions revealed no other difference between the "as received" and normalized conditions. The inference is thus indicated that the abnormal impact behaviour of the steel as received may be due to the development of coarse crystals in the carbonless bands which occur in this material, and the possibility is suggested that the failure of this plate may be connected with the phenomenon of grain growth which has in recent years been discovered in the case of iron and very low carbon steel.

The subject of grain growth is of fundamental importance in connection with the further investigation of this plate, and it is referred to it in greater detail at this point.

Phenomena which are now recognized as coming under the general title of grain growth were discovered and described by Stead[1] and Charpy[2]. A considerable advance in our knowledge of the subject was, however, made by Sau-



FIGS. 7, 8, 9 MICROSTRUCTURES AT 150 DIAMETERS OF THE STEEL, CORRESPONDING TO THE VARIOUS FORMS OF HEAT TREATMENT OUTLINED IN TABLE 3.

veur[3], who made the well-known experiment of straining by compression a conical piece of nearly pure iron, and subsequently annealing the piece thus treated at a temperature below the lowest critical point. On cutting a section and etching it, a band of very large ferrite crystals was found at one point, and this

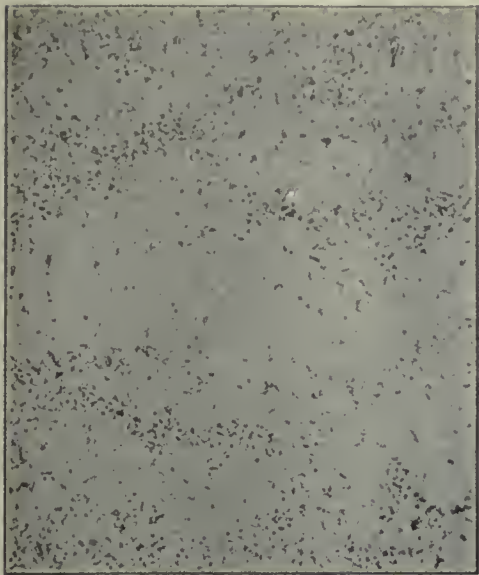


FIG. 10—MICROSTRUCTURE OF PLATE NO. 2 USED EXPERIMENTALLY. VERY LITTLE BANDING PRESENT, THE PLATE BEING ONLY ½-INCH THICK

led to the view that there is a critical amount of plastic deformation which, for a given annealing temperature, below the critical range produces very rapid grain growth.

The subject has been more fully investigated by Chappell,[4] and has also been dealt with in America by Sherry.[5] The latter author has shown that grain growth occurs, not only in comparatively pure iron, but in any region existing in a mass of mild steel from which pearlite is absent or nearly absent—in the carbonless bands such as those met with in boiler plates, provided, of course, that the necessary treatment, consisting of plastic deformation of the right intensity followed by annealing at a correspondingly low temperature, has been applied.

In view of the results obtained by the authors just referred to, the observations made on the boiler plate which forms the subject of this paper at once suggested that the development of coarse ferrite crystals in the carbonless bands of the plate was the result of grain growth following upon deformation in the cold and subsequent low temperature annealing. When it is borne in mind that this plate was bent cold and then annealed several times in succession, it will be seen that the conditions likely to produce grain growth in carbon-free areas had been present.

The authors, however, were not satisfied with a general inference of this kind, but endeavored experimentally to reproduce the conditions under which the steel had developed the coarse and relatively brittle structure which it possessed when received. For this purpose two series of experiments were undertaken. In both series the material was first normalized in order to destroy the previously existing coarse crystals and to bring the material into the condition in which it gives a satisfactorily high impact figure. Deformation was then applied to the material in two ways; in one case, in the cold (by hammering), and in the second case at a temperature between 600° and 700° C., or below the critical range. Specimens treated in both ways were then annealed at 650° C. for 30 min. The microstructure was examined both before and after this last annealing, and impact tests were taken on the material at each stage.

The resulting structure in one of the carbonless areas of the specimen which has been hammered in the cold and subsequently annealed at 650° C. is shown in Fig. 6 under a magnification of 150 diameters. Comparison with Fig. 5 shows at once that considerable grain growth has taken place, although the resulting grains are not quite so large or well developed as those in Fig. 4. The sample which has been hammered between 600° and 700° C. gives a very similar structure, and the impact figure in this case is brought down to 1.56 kgm. per sq. cm.

In order to test the matter further another series of experiments was undertaken in which varying amounts of mechanical deformation were applied in the cold followed by annealing at 650° C. In order, however, to prove that it was not the annealing process alone which resulted in the reduction of the impact figure, the normalized sample was also annealed at 650° C. without previous mechanical deformation. The results obtained by impact tests on specimens thus treated are given in Table 2:

TABLE 2—TESTS ON BOILER PLATE NO. 1

Treatment	Resistance to Impact. Kilogrammeter per Square Centimeter
Normalized at 900 deg. C.	10.46
Normalized at 900 deg. C.	8.92
Normalized; annealed at 650 deg. C....	9.04
Normalized; severely deformed; annealed, 650 deg. C.	11.7
Normalized; reduced 12.4 per cent.; annealed, 650 deg. C.	10.66
Normalized; reduced 7.1 per cent.; annealed, 650 deg. C.	8.44
Normalized; reduced 6.9 per cent.; annealed, 650 deg. C.	10.04
Normalized; reduced 4.9 per cent.; annealed, 650 deg. C.	8.14
Normalized; reduced 3 per cent.; annealed, 650 deg. C.	6.34

In this table the amount of mechanical deformation is measured by percentage reduction of thickness produced by pressing in the cold in a powerful press.

The results given in Table 2 are instructive. It will be seen that large amounts of reduction actually improve the impact strength slightly, but with decreasing amounts of mechanical deformation followed by low temperature annealing the impact strength is very much reduced, although the lowest value obtained in this way, 6.34 kgm. per sq. cm., is still very much better than that

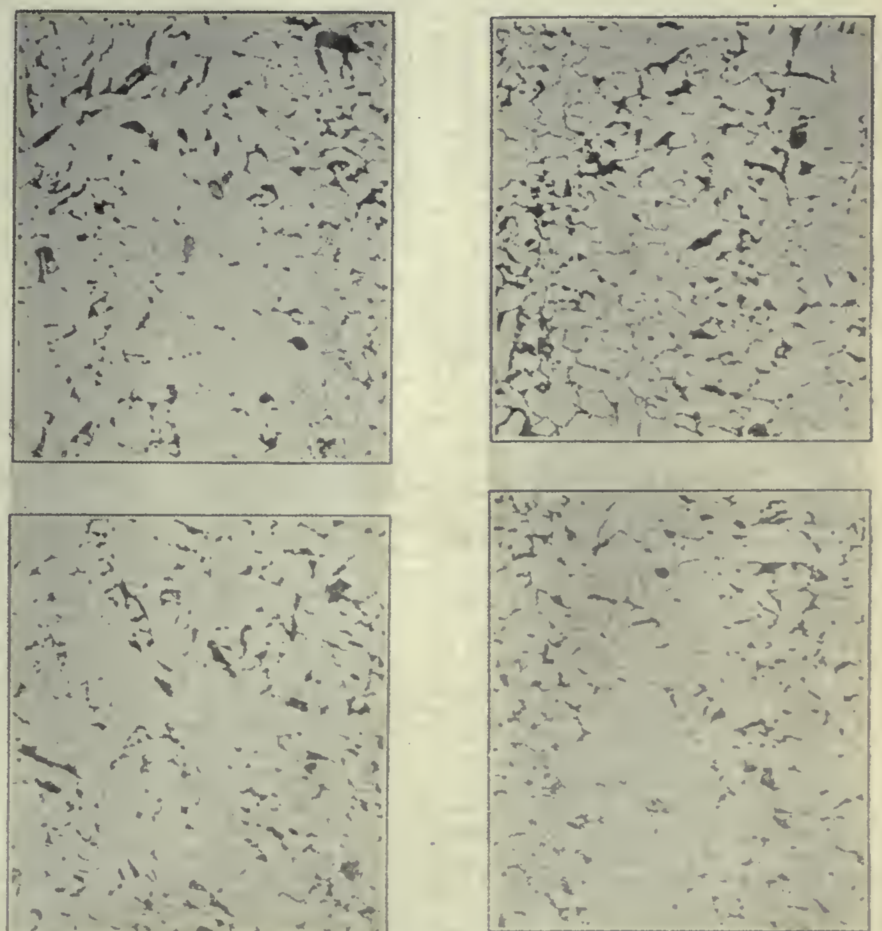


FIG. 11, 12 (UPPER), 13 AND 14 (LOWER). MICROSTRUCTURE OF PLATE NO. 2 AFTER TREATMENT REFERRED TO IN TABLE 2.

found in the plate in its condition as received, or that described in the hammered sample given above. There is nothing to suggest, however, that hammering, as distinct from such deformation as occurs in cold bending, has any specific effect. It should further be borne in mind that when a thick plate is bent in the cold, a considerable range of plastic deformation is produced, ranging from a maximum at the surface of the plate to zero at the neutral axis. Somewhere within this range the critical deformation, corresponding to the annealing temperature employed, is likely to occur.

The microstructure corresponding to the various forms of treatment referred to in Table 2 are illustrated in Figs. 7, 8 and 9, at a magnification of 150 diameters. Fig. 7 refers to the last specimen mentioned in the table having the lowest impact figure and correspondingly showing the largest development of grain growth in the carbonless bands. Fig. 8 refers to the material as normalized and annealed at 650° C. without intermediate deformation. It will be seen that here there is no appreciable difference in grain size between the carbonless band and the adjacent steel. Finally, Fig. 9 refers to the material which has been severely deformed and subsequently annealed at 650° C., giving a high impact figure. Here it will be seen that the grain has been very much refined even in the carbonless areas, and this corresponds in a striking manner with the very high impact figure, 11.7.

When the evidence above described is carefully considered it will be seen to afford a considerable degree of proof of the view that the brittleness, as evidenced by the very low impact figures and actual failure in manufacture which has been found in the plate under discussion, arises from the existence of coarse ferrite crystals due to grain growth in the carbonless bands of the steel, and that this grain-growth is the result of a moderate amount of deformation in the cold, followed by low temperature annealing. It is further evident that normalizing the material, or indeed merely heating it to a temperature above the critical range, is sufficient entirely to obliterate this grain growth and all its evil effects.

It will be seen that this conclusion indicates that the presence of carbonless bands, which is regarded as a normal feature and has not hitherto been considered a serious source of danger or weakness in a boiler plate, may become the cause of failure if associated with a suitable combination of mechanical deformation and low temperature annealing. If carbonless bands are to be regarded as a normal feature in boiler plates—and in existing practice this is probably inevitable—and if deformation in the cold, such as bending, etc., is otherwise a desirable practice, it seems that subsequent normalizing is necessary, or certainly desirable, as a safeguard against dangers of the kind described here.

In order further to test the view which has been advanced above, the authors have endeavored to carry out similar experiments and tests on other samples of boiler plate, but the other samples at their disposal came in every case from plates of much smaller size and thickness, with the result that the banding, where it existed to a marked extent, was on a much smaller scale. Experiments on these plates were, however, made in order that the results might be regarded as a check on the observations already described. In the case of a plate half an inch thick, which may be referred to as No. 2, the chemical analysis was as follows:

	Per Cent.		Per Cent.
Carbon	0.123	Phosphorous	0.057
Silicon	0.014	Manganese	0.49
Sulphur	0.03		

which again indicates a steel of satisfactory composition. The general microstructure of this plate in the condition as received is shown in Fig. 10. A certain amount of banding is present, but not on the scale found in the first plate described. A piece of this plate was

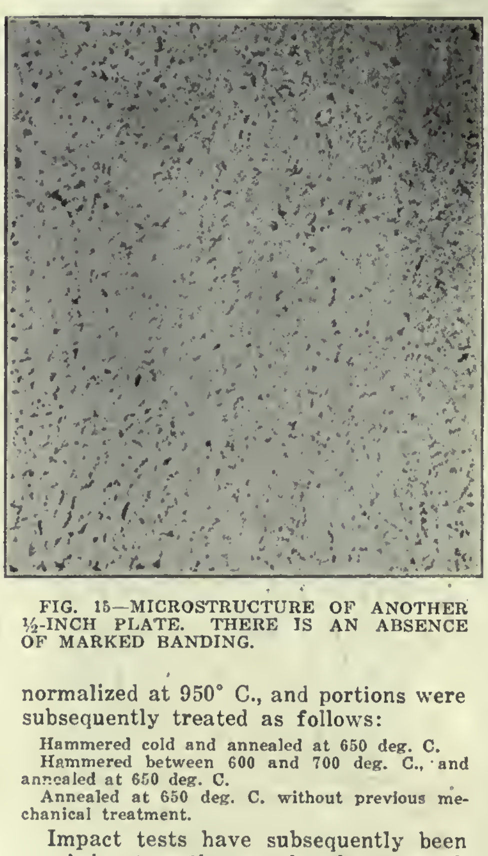


FIG. 15—MICROSTRUCTURE OF ANOTHER ½-INCH PLATE. THERE IS AN ABSENCE OF MARKED BANDING.

normalized at 950° C., and portions were subsequently treated as follows:

Hammered cold and annealed at 650 deg. C.
Hammered between 600 and 700 deg. C., and annealed at 650 deg. C.
Annealed at 650 deg. C. without previous mechanical treatment.

Impact tests have subsequently been carried out on the samples thus treated, with the results given in Table 3:

TABLE 3—TESTS OF BOILER PLATE NO. 2

Treatment	Energy to Fracture. Kilogrammeters
As normalized at 950 deg. C.	11.06
Normalized at 950 deg. C.; hammered cold and annealed at 650 deg. C.	5.52
Normalized, 950 deg. C.; hammered between 600 deg. C. and 700 deg. C., and annealed at 650 deg. C.	7.18
Normalized at 950 deg. C., annealed at 650 deg. C., without mechanical treatment	10.44

It will be seen that the normalized material again gives a high value, and that this value is not appreciably diminished by a further anealing at 650° C. On the other hand, cold hammering followed by annealing at 650° C. lowers the impact figure to one half of the normal value, while hammering between 600 and 700° C. reduces it considerably but to a lesser extent. The corresponding microstructures are illustrated in Figs. 11, 12, 13 and 14. Fig. 11 shows the material as normalized, Fig. 12 shows it after normalizing and reannealed at 650° C. without mechanical treatment, Fig. 13 shows the effects of cold hammering followed by annealing at 650° C., and Fig. 14 shows the effect of hammering between 600° and 700° C., followed by annealing at 650° C.

It will be seen that, in general terms, the results obtained with this material are of the same kind as those found in the first plate but, probably owing to the smaller scale of the banding originally existing in this steel the results are not quite so intense in character. It may be mentioned that this plate also had failed in practice, but not during manufacture, and in a manner which is not necessarily related to the phenomenon of grain growth. The experiments on this plate serve to confirm the observations made with the first example, but they indicate that in plates of a smaller thickness the effects are not likely to be so serious as in the larger plates.

The results obtained with plates Nos. 2 and 3 thus confirm the view that the low impact figures found in the first plate, and to a lesser extent in plate No. 2, are associated with the coarse crystal structure in the carbonless bands, and that these are the result of grain growth produced by slight deformation and subsequent low temperature annealing; also that normalizing in every case completely removes this source of weakness.

[1]Stead, *Journal of the Iron and Steel Institute*, 1898, No. I, p. 145; *ibid.*, No. II, p. 137.

[2]Charpy, *Comptes Rendus*, vol. cli.

[3]Sauveur, *Proceedings of the International Congress for Testing Materials, Sixth Congress*, 1912, vol. xi.

[4]Chappell, *Journal of the Iron and Steel Institute*, 1914, No. I, p. 460.

[5]Sherry, *Faraday Society*, December, 1916.

New Patents Out.—The following is a list of Canadian patents recently issued through the agency of Messrs. Ridout & Maybee, 59 Yonge street, Toronto, from whom further particulars may be obtained: Samuel R. Kitchen, spring mattresses and the like; Harvey M. Russ, dump wagons; Albert E. Salway, multicylinder internal combustion engine; Joseph H. Price, sights for rifles, pistols and the like; William Wilkie, machines for opening and pressing the seams of wearing apparel in the process of manufacture; John G. Robinson, steam superheater; Robert Blakoe, tires of motor cars and other vehicles; Carl F. Doerschuk, self-locking device; Thomas Mitchell, shim boring and cutting machine; Frank D. Parmenter, attaching means for electric fixtures.

Copper ranks next to steel as the most important war metal. Of a world's production of approximately 3,100,000,000 pounds in 1917, the refineries of the United States produced 2,362,000,000 pounds, or a trifle less than 80 per cent.

THE BASIS OF SCIENTIFIC MANAGEMENT

By M. H. Potter.

IN the course of a short time two establishments in the same industry, in the same locality, built for them in same buildings, equip them with the same machinery and establish for them similar methods of handling equipment and materials—yet, there will be a difference in both the quantity and the quality of their output. This difference in result will be caused by the difference between the two in the quality of their personnel. For this reason alone the question of personnel must ultimately be considered the real problem of management.

If one of the plants mentioned above were headed by a management of the ordinary or traditional type and the other by a management which fully realized the importance of personnel and had developed an active philosophy tending towards the solution of the personnel problem, the difference in practical results would be so great as to be unbelievable by the uninitiated. In fact, this difference alone would often spell failure in the one case and success in the other.

The managers of both plants would see the shortsightedness of letting buildings and other equipment run down for lack of upkeep and repair. Both would see the value of and put into practice means of running the machinery at the most efficient speeds and bringing into use the best tools and the best method of handling material. It would be taken for granted by both that anything that goes to the improvement and upkeep of these things would be a necessary expenditure or a wise investment. The ordinary management, however, would not think of applying the same laws of upkeep and improvement to the personal equipment.

The ordinary or unscientific manager believes that factory management consists of the handling of orders, materials, and machinery, and that the men in the plant are a mere adjunct to these things—a necessary evil. When this type of manager is confronted withe the fact that his organization is less efficient than another he will lay the blame on his employees.

The old type of management would at the least consider expenditures for the development of personnel as an unnecessary outlay forced upon it by unintelligent public opinion, or would consider it a politic expenditure which would bring a certain amount of cheap advertising at the expense of fair wages. The enlightened, or scientific type of management would consider expenditures of this kind not only wise, but also an investment bringing proportionately larger and more permanent returns than all other kinds. Full value of all expenditures or investments for upkeep and improvement of a plant can be realized only when sufficient investment of both time and money has been made for the purpose of improvement and upkeep of the personal side. In fact, the management which has the correct viewpoint will find that the mechanical and material side of the organization will be better developed as a necessary incident to personal development than it would be where this point of view is reversed.

Only actual comparison of the mechanical and other developments in the establishments of up-to-date manufacturing plants would suffice to prove this point. The usual type of management is at the best only beginning to realize the existence of the personal side. As a result, machinery and equipment are almost universally unlimited. In like manner the proper handling of materials and the installation of other methods developed under scientific management have been introduced in the establishments as necessary steps in the development of the highest efficiency of the individual.

Scientific Management

Scientific management aims directly at increasing the quantity and quality of the output of the individual worker. While scientific management in its application must necessarily go deeply into the question of improved machinery and equipment, and while this in itself makes for greater output, nevertheless, a machine is a tool, and, like any other tool, is devised to increase the efficiency of the individual to whose direct and personal control it must always be subject. The question of quality, even in the case where highly developed machinery is used, is almost entirely a question of the personal element. As for the question of quantity, the real measure of accomplishment is not output per machine or per tool, but output per man.

Scientific management will not have completed its mission when it has determined in each industry the best method of handling materials and equipment in relation to workers, but when it has determined also the principles which underly correct methods of handling men. It is the purpose of this article to show what is being done from this point of view and what a little effort in the right direction can accomplish. A further purpose of this article is to bring to the attention of those interested in the future of scientific management the degree to which management is, in the final analysis, the handling of men and to emphasize that scientific management is scientific only in so far as it recognizes the fact.

From the point of view of the writer the responsibility of handling men from the time of their original selection is the most important responsibility of factory management. It is this responsibility which creates the function of employment in its broadest sense. It is only beginning to be recognized, however, that employment is a function of management. Even where considered or essential part of management, the employment function , with few exceptions, consists only of the original selection of applicants.

Scientific employment includes not only the selection of new employees, but also the keeping of every position in the organization permanently filled with the right kind of man or woman. The main part of scientific employment begins after the act of hiring is completed. Considered from this point of view, it is one of the most important functions of management, and one that requires constant scientific analysis and development. While a very small organization may not be able to afford even one person whose sole function is the business of employment, this activity should nevertheless be recognized as a separate and most important function and in such cases administered by the manager or assistant manager himself.

This employment function can under no circumstances be administered preperly by some head or underling of an operating department. Many of the questions with which the employment department has to deal are questions in which an operating head is an interested party; his very position, therefore, disqualifies him from administering this function. The qualifications required of such a person are essentially different from those required of one administering an employment department. Moreover, the qualifications which are generally considered essential to the head of an operating department are special knowledge or mechanical ability and sometimes a certain amount of executive ability. While some executive ability is useful asset in administering the employment function, the chief qualities required are capacity to investigate and judge impartially, tact. a sincere interest in human affairs and a personality that inspires confidence.

Functions of Management

All responsibilities of the management in the direction of personal service, directed toward the welfare and development of the individual, are part of the function of employment.

While as already mentioned, hiring is only a small part of the function of employment, nevertheless, the solution of the problem of selection is of great importance in its bearing on the whole future development of the worker. All applicants are interviewed by one of the heads of the employment department. Certain specific information concerning the applicant is obtained in every case and entered on a blank for the purpose. Information deemed essential consists of

Name and address.
Date of application.
Date and place of birth.
Date of immigration, when naturalized.
Parentage.
Languages spoken.
Education.
Married or single.
Number in family.
Record of previous employment.

The idea should be to keep such records as simple as possible, only the important details being entered.

Information as to past employment is important as a record of experience and earnings. The number of positions held is also an indication as to whether or not the applicant is steady.

Interviewing

The interviewing of applicants is important and requires considerable tact, judgment and experience. Ample space should be left on every application form for making notes as to the individual's special qualifications as well as any other circumstances surrounding the case. As judgment is essential, and as judgment is influenced by immediate impression, no one is employed on the date of application. Postponement of selection tends to bring all applicants in their proper relationship in the mind of one who has the responsibility of their selection. This method moreover, tends to reduce the number of unsteady help who otherwise might get on the payroll.

Application Records, Classification

Application records are classified as to sex, age and apparent suitability. When a position is to be filled one or more applicants are sent for. A definite time is set for their appearance and self-addressed postal cards are enclosed to be mailed in case appointment cannot be kept. At this time selection is made for immediate employment and the fitness of the applicantt is more definitely determined. Since help has become rather difficult to secure in many localities, this rule cannot be carried out successfully, but whenever possible, the results obtained are far more practical.

As a rule in industrial establishments where the question arises at all, only fitness for the work is considered. There are, however, two kinds of fitness to be considered, provided a person is suited for industry at all; one is fitness for the position, the other is fitness for the organization. Of these the latter is by far the more important.

Fitness for the organization is chiefly a question of character. Every organization has a distinct character of its own, which is often recognized as being a tangible business asset. It is essential, therefore, that every member of the organization have a character sufficiently developed or capable of development to be in harmony with the character of the organization. No matter how skilled or fitted one may be to do a given piece of work, or to operate a certain machine, if he is out of harmony with the spirit of character of the organization, he will be an everlasting detriment to himself and all others in the organization who come in contact with him.

The interviewing of the applicant by a trained head of the employment department is the basis of predetermining as far as possible both the fitness for a position and for the organization. In judging fitness for a position, past experience, where there is any, is sometimes a guide. At the best, however, it is a guide of only doubtful value. Personal choice can be taken in some instances also as a guide. This predilection furnishes in itself a valuable incentive. Often, however, it is important to weight carefully all the reasons for the predilection.

The applicant's fitness for the organization, while more important, is more readily predetermined by interview. The interview at the time of employment is very thorough and designed to explain to the prospective employee the character of the organization and its policies, and the responsibilities of the organization to the employee as well as the responsibility of the employee to the organization.

Physical and Mental Fitness

As the aim of the employment department is to keep every position in the organization filled with fit men and women, the question of physical and mental fitness of the individual is of prime importance. The equipment includes a dispensary, separate rest rooms, a waiting room and a consultation room for the factory physician. Through systems of safety devices and instructions, accidents of both major and minor kinds have been reduced to a minimum. Minor accidents when neglected cause a great deal of inconvenience and much loss of time due to infection.

Only one who has gone deeply into the question of health in its relation to efficiency can realize the loss occasioned by lack of knowledge and attention to even the simplest rules of hygiene. A great deal of work is constantly required to educate people to realize the necessity of fresh air, proper diet and regular hours, lack of attention to one or all of which is often the cause of inefficiency. The care of the eyes and teeth is most important and is receiving care and attention from the factory physicians.

Along with the question of physical fitness must be considered the mental fitness of the individual. Not only does his capacity for certain kinds of work, but also his general fitness for the organization and his ability to advance depend to a great extent upon his mental fitness. Education is valuable in industry only so far as it develops the use of intelligence and character. The limitations to the use of such tests must be well borne in mind, and the error of making generalities must be avoided. Tests of this nature can not determine what a person can do, but are valuable only in assisting in determining what he cannot do. Recreation forms a big factor in the follow-up work of the individual. Noonday recreations are beginning to be recognized for their beneficial effect in industrial work. Separate reading rooms and recreation rooms are also maintained.

Library

One of the very useful means toward general education and development of the individual is the library. Good reading is promoted and in many instances special reading courses are provided. Definite information is furnished by the employment department concerning special classes in the public schools and other institutions.

Another feature that has justified its existence is the bank. Interest is paid on all deposits remaining in the bank three months or more. A special department is maintained in the interest of the war savings loans and through canvassing amongst the employees amounts deposited in this direction are increasing regularly.

It is impossible to touch upon all the features of the useful service performed in a practical, daily administration of the employment department. The chief thing is its personal contact and follow-up. Steadiness of employment must be considered not only from the point of view that it is desirable for reasons of profit, but also from the point of view that it is a responsibility of the management to furnish a steady and efficient employee with steady opportunity. From this point of view alone it becomes the duty of the management to standardize the work and working conditions. The standardization of the purchasing and handling of materials to maintain an even flow and an even balance of work is not alone essential, but the balance of employees is also of greatest importance. In most industrial organizations it will be found that there are constantly employed for a given purpose considerably more people than are necessary to turn out the work. In such instances it will also be found that the number of people employed varies to such a degree that there is not only no opportunity given for steady employment, but the distribution of opportunity varies from time to time. Means such as are used under scientific management for determining the standard methods and standard times for performing a task should be used to determine the exact number of people to be maintained in every position.

Sales Policy

In this connection one of the most important things is the sales policy. Many businesses have not a sales policy or sales organization worthy of the name. It is only in exceptional instances that the sales policy and the manufacturing policy are properly co-related. Ordinarily the sales department is administered with entire disregard of its most important function, to market a product that will permanently be of most profit to the entire organization.

Only a thorough realization of all the actual problems and earnest efforts towards their solution will bring results. While the greater part of these results shows in the spirit of the organization and in the spirit of its personal relationships and can only be judged by actual investigation, an important result is a decided steadying of the working force, which can be judged by accurate data.

In regard to "quitters" a little more explanation is necessary. Very few people realize the tremendous cost to industry from this cause. Various estimates of this cost have been made. These estimates vary from fifty to two hundred dollars per person, depending upon the nature of the work and character of employee obtainable and the percentage of old employees who are retired. Taking even the lowest possible estimate, it would seem that any reasonable outlay of both money and effort for the purpose of reducing this industrial waste would be justifiable.

Labor Turnover

For the purpose of compiling comparable data as regards "labor turnover," standard practices should be established. The average standing payroll for any given period should be the basis as this gives the average number of positions to be filled. In case there is a general reduction in the number of positions during the period, the percentage of new employees to the average standing payroll should be taken. In case there is an increase in the organization, the percentage of "quitters" to the average standing payroll should be taken. In the first case that amount by which the number of "quitters" exceeds the number of new employees will account for the reduction. In the second place, the amount by which the new employees exceed the number of "quitters" will account for the increase.

It can easily be seen how intricate are the problems involved in the handling of men. Every step toward the solution of these problems is a step in the direction of democracy. Efficiency as a whole is accomplished by efficiency of the individual and efficiency of the individual is accomplished only by methods involving personal contact.

The open road to talent is an essential to every successful organization. Practically all positions in the organization including semi-executive and executive, should be filled by those who by reason of sheer personal merit have come up from the ranks. One of the most important functions of the employment department is to develop organization spirit and free expression from its source to the ear of the management. In fact, the chief purpose of a scientifically organized department is nothing more than the development of that intimate personal contact so necessary to management.

It is estimated that about one-fifth of the total number of employees may come daily in contact with the employment department. All cases where direct contact with the management would be beneficial should be immediately referred to it. This requires constant daily contact of the management, and brings it into intimate relationship with a great many more cases that would be possible in the average organization of much smaller size. Wherever the management assumes the policy of the closed door, this department may well be shut down.

Results cannot be accomplished in the spirit of charity, but must emanate entirely from a sense of justice. It must be understood that work along the lines described above can never take the place of wages. Such work must have as a reason for its existence not only increased efficiency, but the increased reward to which increased efficiency is entitled. The increase in efficiency in one plant in respect to wages during a period of four years is as follows: Production 45 per cent., average individual hourly wages of 45 per cent., weekly wages 37 per cent., total manufacturing cost of about 10 per cent. During this period the weekly working schedule was reduced from fifty-four to forty-eight hours.

Results such as these are obtainable only when scientific management is scientifically applied. Scientific management will live if for no other reason than that it has faced the problem squarely and recognizes that the science of management is the science of handling men.

AN ELECTRIC CRANE TRACTOR

The accompanying illustration shows an electric crane tractor, having a maximum gross trailing load capacity of 15 tons, with an automatic type coupler for hitching to trailers. It is provided with a removable battery compartment to facilitate interchange of batteries and a balance drive is used.

The crane has a maximum capacity on the hook of 4,000 pounds and it is provided with an electrically operated hoist of the swinging goose-neck type.

As a tractor these electric labor saving devices meet the demand for all short heavy tractor-trailer haulage on ordinary

AN ELECTRIC CRANE TRACTOR

age problems are best solved by these electric tractors hauling trailers, it is pointed out, as they are similar to the payements. They are said to be efficient and economical and have the same advantages as electric trucks. Many haul-Industrial trackless trains, but only on a larger scale, the electric tractor being a full sized and rugged road type vehicle. Such operation is of great value where there is large tonnage to be hauled over short or moderate distances.

While it is possible for the tractor unit, which is the more expensive part of the equipment to be worked intensely, it does not necessarily follow that a tractor trailer equipment costs less than one of motor trucks. A great saving does result, however, from the lessened labor required for drivers and motor truck mechanics. This is a feature needing no emphasis now that a shortage of such labor is an unpleasant reality. This proves to be a fact whether gas or electric types are considered, but is overwhelmingly true where electric tractors are compared to gasoline motor truck equipment.

The electric transportation equipment has a recognized lessened "fire risk" and for that reason electric tractors or trucks are allowed by the underwriters to be operated practically without restriction in and about congested terminals, docks and warehouses, where gasoline equipment is tabooed. It also follows that at least a portion of the haulage problems of all these institutions are being advantageously cared for by the installation of Walker electric tractors.

Its uses as a crane are of the greatest importance as a considerable portion of the freight handled by trailers or other forms of transportation is heavy and unwieldy. Where handled by hand or other slow methods this has always involved a high labor cost. As will be seen this crane tractor is equipped with a swinging electric goose-neck crane on its forward end by which it is possible to expeditiously and economically handle unwieldly and heavy or bulky material. By placing the vehicle in an advantageous position by use of the swinging crane the material is secured, hoisted and transferred to or from trailers, wagons, motor trucks, box cars or convenient piles.

Practically the only limit of rate of working of this novel device is the speed with which the attaching and detaching operations can be carried out. Material in small quantities is sometimes carried on hook with the advantage that the delivery point may be the floor, the top of a pile, or the loading space of a box-car or truck. The article is placed exactly where desired, and for emergency calls the entire operation takes less time than would ordinarily be required loading the article on to a wagon or a truck. The dexterity with which the various operations can be carried out is proving a revelation to the uninitiated, for not only is the time reduced, but the attendant labor necessary is but a fraction of that required by the older methods. This unique equipment is a most effective electrically operated labor saving device and is being extensively introduced into industrial service.

SYNTHETIC RUBBER

A very instructive communication on the difficulties with which Germany has to contend owing to the dearth of the most important raw materials for the war industries was made by Dr. Duisberg, one of the leading chemists of the Elberfeld Farbenfabriken, in the meeting of the Bunsen Gesellschaft, held at Berlin in April last. It will be remembered that in the years 1910 to 1912 Fritz Hoffmann, of that firm, had succeeded in preparing isoprene and dimethylbutadiene, hydrocarbons somewhat resembling benzene, which on long-continued boiling (for weeks or months, it is now admitted) turned into a substance which showed the chemical reactions and some of the properties of caoutchouc. This synthetic product was used as a rubber substitute or as addition to rubber, and the process seemed commercially possible in those days when rubber was in Germany 30 marks per kilogramme. When the price went down to 4 marks, the Leverkusen works of the firm gave the new process up. There was another process, tried and afterwards abandoned, in these works: reduction of acetone by means of aluminum to pinakone, which is closely related to methylbutadiene. The war once more forced attention on these processes. Meanwhile, however, aluminum and acetone had become equally rare and precious. As regards aluminum the manufacture of the metal was taken up in Germany, which has now three works. With respect to acetone, potatoes had been a raw material, but they could not be spared any longer. Bottinger found that with the aid of the bacillus macerans he could make acetone from putrid potatoes, the fermentation yielding a mixture of about two parts of alcohol and one part of acetone; but the bacillus proved very sensitive, and the process was not a success on a large scale. Calcium carbide was then utilised to a larger extent than before the war; it yields, with water, acetylene which in the presence of a contact substance (mercury salts) is converted into acetaldehyde; the aldehyde can be oxidised to acetic acid; blown over another contact substance the acid loses the elements of CO_2, turning into acetone. This process is worked at Leverkusen, at Hochst and at Burghausen on the Alz. The rubber manufacture was then resumed. The rubber industry was not favourably disposed to the new methyl caoutchouc, however, which was not real rubber, absorbed oxygen from the air, and gave trouble in the vulcanisers. This trouble was overcome by the aid of piperidin and other ingredients. The new hard rubber (ebonite) so improved was equal to the old product and dielectrically even stronger; the accumulator boxes of the U-boats are made of this ebonite. The soft rubber, however, was not perfect yet; at ordinary temperature it resembled leather more than rubber, and became elastic only when warm. The addition of dimethylaniline and of toluidine—both valuable products, it need not be pointed out—cured these defects. In the improved condition the rubber is used for making the tyres for heavy motor vehicles and also for artificial teeth. The Leverkusen works can now supply 2,000 tons of rubber per year, which is about one-eighth of the amount of rubber wanted. Meanwhile Merling has prepared isoprene from acetylene and acetone; and that process, though still in the experimental stage, is also regarded as promising. As to the outlook for these synthetic rubbers in normal times Dr. Duisberg was guarded.—"Engineering."

A saving of coal equivalent to 350,000 tons annually already has been effected by the Fuel Administration in its conservation campaign among the steam power plants, it is stated officially. This saving has been effected through the inspection of 300 plants. It is the intention to inspect each of the 250,000 steam plants of the country. The saving is declared to be the result of applying more efficient firing and operating methods. It has been brought about without curtailment of output.

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Address your copy and drawings to Editor, Canadian Machinery, 143 University Avenue, Toronto.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

STRAIGHT EDGING AND JOINTING MACHINE

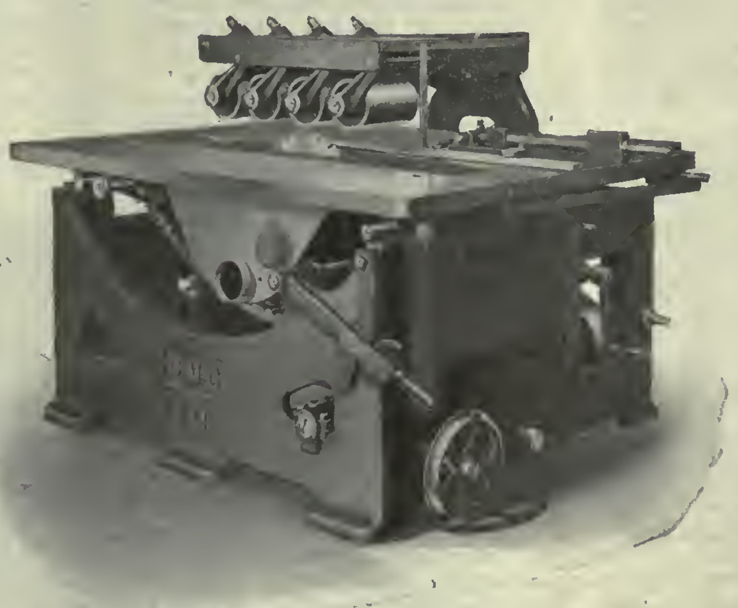
A recently designed wood working tool seen at Toronto Exhibition apart from its mechanical merit deserves attention on account of its strictly Canadian origin and design. In designing the straight edging and jointing machine shown here the Canada Machinery Corporation, Galt, have produced a machine whose excellent mechanical design renders possible accurate and quantity production.

Former machines designed for similar work were made with an overhead movable arm supporting the saw arbor with the feed chains travelling in the saw table and grooved to clear the saw blade. Many disadvantages resulted from the overhead suspension of the saw arbor, cuttings were extremely hard to dispose of properly and short stock was difficult to saw without contrivances apt to get out of order. The placing of the saw arbor below the table and the making of the machine into an under-cutting type at once removes these difficulties and provides a machine which is capable of sawing pieces as short as 7 in. and which permits of the feeding of one piece immediately after another so that the cutting of the saw is continuous.

To saw pieces as short as 7 in. in the older types of machines a smaller blade was necessarily required and, as is well known from experience, a small saw requires a much higher speed and more power to equal the performance of a moderately sized saw and permits of a better cutting angle for the saw teeth.

The drive from the countershaft is extremely powerful, an 8x8 in. pulley being provided for driving the saw mandrel. In consideration of the fact that an adequately supported and well proportioned mandrel is essential to good work the mandrel has been made 1 15-16 in. diameter and is supported in three long 7 in. bearings. An adjustable and thrust is provided for the taking up of end play resulting from wear. The mandrel or saw arbor runs as quietly and as smoothly as a shaper spindle.

In the mounting of the saw blade on the arbor considerable attention has been given to the securing of a strong and rigid connection. 7 in. collars are provided on each side of the blade permitting the use of thin saws and the saving of stock. The saw arbor is carried through these collars and the assembly is securely fastened by a 1 1-8 in. nut on the end. Coned bushings are provided which automatically center the saw in the correct position on the arbor. The provision which has been made for removing saws is an especially commendable feature. Saws can be removed and replaced with the utmost facility, the time taken being no longer than that required to remove blade from an ordinary rip saw. A movable section of the table, on being actuated by a crank, carries with it to one side one of the feed chains and exposes the whole saw mounting to view.



STRAIGHT EDGING AND JOINTING MACHINE.

The feed consists of two travelling chains with serrated surface, one on either side of the saw blade. These chains are supported in long ways provided with adjustment for wear and are cleaned and oiled at each revolution. The truth of cut depends entirely on the travel of the chains whose vertical height is adjustable to suit either rough or smooth lumber.

The stock is held to the feed chains by heavy feed rolls swing suspended and under the action of heavy feed springs. The feed mechanism is driven by a combination of cone pulleys and reduction gears from the saw arbor. Four changes of feed, 50, 75, 115, and 175 ft. per minute, are available through four step cone pulleys actuated by a handwheel. A handle is provided for instantly disengaging the feed.

The production may be estimated from machines in use which are ripping 1 in. kiln dried maple at a rate of 115 ft. per min. and 2 in. similar stock at 75 ft. per min.

The machine when used with a planer tooth saw will take a cut so straight and smooth that the stock can be glued up without further dressing, and one machine can break out as much stock for table tops, dressers, etc., as 4 or 5 hand-feed rip saws. When stock is being edged by hand the operator must keep his blade within the stock, thus wasting lumber, whereas the 6x11 saw will dress along the edge without gouging.

In the design of this machine the operator's safety has been the first consideration and under no circumstance is it possible for the operator's hands to come into proximity to the saw blade, and it is impossible once the stock is engaged in the feed mechanism for it to be thrown back on operator. The efficiency and comfort of the operator is also provided for by the sawdust hood which, on account of the saw being driven from below, carries away all dust and trimmings.

The capacity of the machine is such

that it will take stock 29 in. wide and in thicknesses up to 3 in. with a 14 in. blade.

The table and feed rolls are raised and lowered by sq. thread screws equipped with ball bearings to take end thrust. The fence is instantly adjustable and is of the self-locking type and is provided with a graduated scale on the front bracket.

A workman of average intelligence will in a few days become quite proficient in the operation of this machine.

In one plant two of these saws are in operation On each saw is a boy feeding in stock and a girl taking stock away. This work was formerly done by experienced men, using band rip saws and hand-feed circular saws.

OIL BURNING REFINING FURNACE

A furnace which is adaptable to a wide range of uses in the refining of iron has been developed by Edward H. Schwartz, 436 Marquette Building, Chicago. At the plant of the Garden City Foundry Co., Chicago, the furnace is operated in connection with a cupola and the finished products are refined deoxidized semi-steel, refined deoxidized semi-malleable and gray iron.

In the installation shown the furnace receives iron direct from a 54-inch cupola, the spout from which enters the furnace at one side. Scrap is used almost entirely and often no pig iron is employed in the mixture.

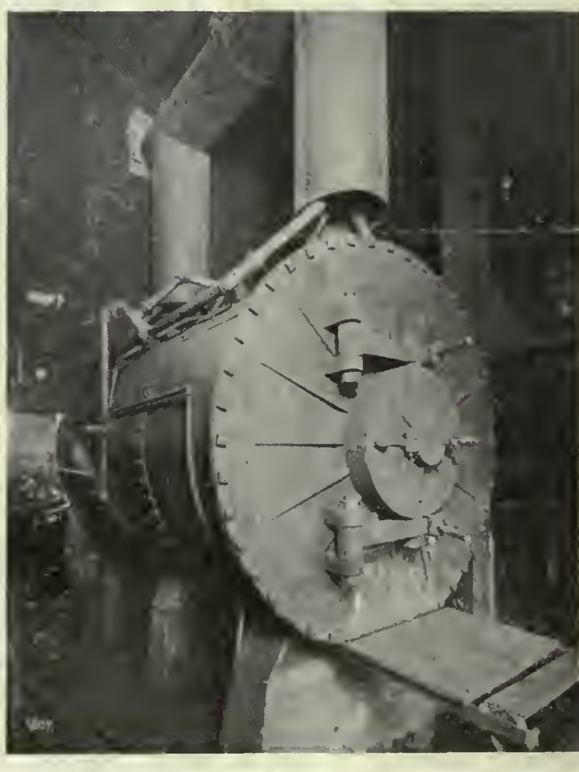
In making the deoxidized semi-steel, steel scrap is charged in the cupola with a small percentage of spiegeleisen to aid in picking up carbon from the coke. This alloy also assists in deoxidizing and supplies manganese in addition to fixing some carbon. In order to supply the proper amount of silicon, ferrosilicon is added after the metal is transferred to the Schwartz furnace. There is a small refining loss of ferrosilicon which is taken into account in proportioning the mixture. Other alloys are added as desired to the charge in the furnace at the beginning of the refining process. An hour of refining is sufficient. A tensile strength of 50,000 pounds per square inch has been obtained in a bar machined from the center of the casting. Steel is produced by charging steel scrap with spiegeleisen in the cupola. Some of the sulphur is removed in the refining furnace by the formation of manganese sulphide. Additions of manganese and silicon are made at the end of the heat. Sulphur and phosphorus also are eliminated in the furnace by the addition of limestone to form a slag. Malleable iron is made by charging steel scrap and spiegel in the cupola with additions of silicon in the refining furnace in the form of ferrosilicon. Deoxidized semi-malleable refined iron is produced by charging malleable scrap and spiegel in the cupola. Silicon and alloys are added in the furnace during the refining process. It is said a tensile strength of 41,000 pounds has been obtained in an un-annealed machined bar. The metal may be hammered like malleable, has bending qualities and takes a high polish.

The refining operation in the furnace is relatively simple. The action of the flame cleanses the metal, removing the free carbon, oxides and occluded gases. The metal is heated until it is still and dead like crucible steel. Slag may be used to remove sulphur and phosphorus if they exist to too high a degree in the scrap.

The furnace is cylindrical with cast steel ends and steel plate walls. It is 6 feet 6 inches in diameter and 10 feet long, and is lined with firebrick to a thickness of 10½ inches. A removable bottom 4½ inches thick extends above the slag line. This bottom consists of chrome, silica or magnesite brick as neutral, acid or basic effects are desired.

The charging door, in the center of one end, is circular. It is mounted on hinged arms and its machined face fits accurately, avoiding the necessity of clay luting. A smaller door in the center of the charging door covers a peep hole through which progress of the refining operation can be readily observed. This arrangement is clearly shown in the accompanying illustration. In the center of the end opposite the charging door an aperture is left for inserting a lighter to ignite the gas at the beginning of the process. This aperture is luted shut after the flame has been started. A testing door and slag hole are fitted on one side. Two vents are placed in the top, one near each end, with a vent hood and short stack. The waste heat from the furnace passing up these stacks preheats air passing down through pipes leading from the outer air to the gas burner. The current of air in these pipes is maintained by the vacuum action of the burner, which has 5 per cent. of compressed air supplied to it. The burners, it is said, are under absolute control by one valve. Three burners are placed in the top of furnace. One, in the apex of the arch, carries only preheated air. The other two are 45 degrees from the apex, in line with the first, and carry mixed gas and air. The currents from the three meet at the center of the furnace. It is claimed that temepratures of 5000 degrees Fahr. have been obtained.

A metal of uniform analysis for the manufacturer of shells is produced as semi-steel, with a tensile strength of 40,000 pounds. The furnace may be operated independently of a cupola, charging the cold scrap direct if desired, but this requires more time for melting and refining. The furnace at the Garden City plant is operated on gas from city mains. It contains about 500 b.t.u. per cubic foot. As stated about 5 per cent. of compressed air is employed, the remaining per cent of air being drawn in by the vacuum thus established. About 10 volumes of air to one of gas are delivered at the burner. Changes in supply of gas and air are controlled by one valve. Gas supply is reduced to obtain higher oxidizing action and the proportion of air is reduced to obtain a reducing effect. During the refining action the flame usually is maintained at the neutral point.



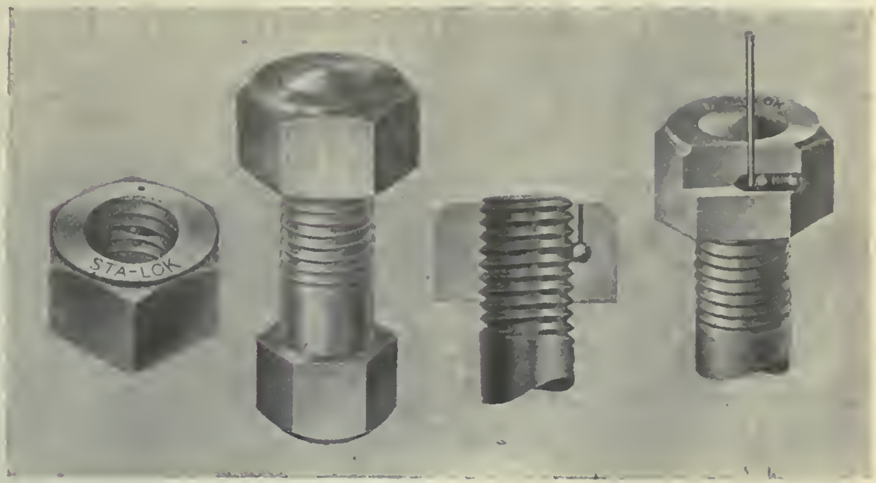
SCHWARTZ STATIONARY REVERBERATORY STEEL MELTING AND REFINING FURNACE

DRAW CRUCIBLE FURNACE

The furnace illustrated herewith has been designed for the consumption of either gas or oil and is adapted to the melting and refining of metals where it is desired to pour the metals out of the same crucible in which they have been melted.

The furnace is cylindrical and is in two parts, the lower part is the combustion chamber and the upper part is the crucible chamber, an airtight seal is formed between the lower edge of the crucible chamber and the combustion chamber, into which the crucible chamber drops when the furnace is closed. Within the walls of both parts is contained a conduit or passage way from the blower to the burner with airtight joints connecting the two units. The combustion and crucible chambers are cylindrical and are lined with a refractory of shapes designed to fill the exact area and to key in place. In the combustion chamber is placed a refractory stool for the crucible and mounted at the rear of the base are columns supporting pulleys and cables which raise and lower the crucible chamber by a pinion, A counterweight being provided to bal-

OIL BURNING FURNACE CLOSED



DETAILS OF LOCKNUT SHOWING OPERATION AND METHOD OF UNLOCKING

ance the weight of the crucible chamber. The air in its passage from the blower to the burner is forced through conduit in the walls of the combustion and crucible chambers and reaches a temperature of 450 to 550 degrees and thereby cools the temperature of the walls, giving thorough atomization of the fuel and complete mixture of the fuel and air, which is an essential point in the production of the desired short flame. The flame enters the chamber, tangentially around the stool and crucible completely fills the space around it, and when adjusted properly does not measure in excess of 1½ feet in length. This

FURNACE OPEN FOR REMOVAL OF CRUCIBLE.

furnace is manufactured by the Iler Co., Cleveland, Ohio.

IMPROVED NUT LOCK

The Evertite Nut Corporation, Detroit, Mich., have developed a lock nut possessing valuable features. The action of this nut is simplicity itself. Under forces tending to unscrew the nut a hardened steel ball running between the bolt threads and maintained in immediate contact with them by a spring is forced to wedge in the thread, instantly tightening the nut to absolute immovability. As a result no amount or severity of vibration will ever loosen the nut.

The Stay-lock nut is manufactured from bar screw stock and the special shape given to the nut makes it impossible for anyone to mistake it for an ordinary nut.

The nut is released by inserting a small finishing nail in the key hole and applying a wrench. Should the keyhole become filled with dirt it may readily be cleaned by inserting a pin or small wire.

POTASH IN FURNACE DUST

London.—The Board of Trade Journal publishes a remarkable article on the British supplies of potash, showing the important progress which has been made during the war in the production of potash in Great Britain.

One source of the new supply is from blast-furnace dust, from which potash is obtained by a cheap and simple process, consisting primarily in an addition of a small proportion of common salt to the charge of the furnace, which releases the potash present in the ore and causes it to be volatilized with the emerging gases as potassium chloride.

As the result of experiments on a large scale it was estimated that it would be possible to recover 50,000 tons of potash salts per annum from blast-furnace dust alone—enough practically to meet the needs of the country.

A factory already has been erected at Oldbury, near Birmingham, designed to produce 400 to 500 tons of potassium chloride weekly from blast-furnace dust and a conversion factory is to be added where chloride, not needed for agriculture, may be converted into other refined potash salts. Other factories are in contemplation, and it is expected to obtain especially large quantities of potash from the important Cleveland iron district.

In view of the new importance thus given to blast-furnace dust, dealings in this raw material were placed in August, 1917, under Government control, which is working very smoothly.

Large quantities of potash can similarly be collected from fumes and dust from cement kilns, and potash now is being sold by many cement manufacturers who hitherto had no idea that such valuable material could be so easily collected.

The war has given an impetus to Canadian trade expansion unequalled in our history. In considering the coming of peace the question is put not infrequently to this Department: "What are you doing to prepare for the commercial struggle that will follow the war?" This question and others can be put more appropriately to the business men of Canada: "What are you doing to prepare for the commercial struggle that will follow the war?" "Are you studying the possibilities? Are you studying every phase of the cost of your raw materials, and what effect peace will have on supply, labour, transportation, and market?" The Government has its limitations. It can assist by pointing the way to foreign markets.

J. H. Hall, of the Monometer Mfg. Co., Birmingham, Eng., has invented a machine for recovering tin and solder from old cans and scrap. It consists of an inclined cylinder which rotates within an outer cylinder lined with firebrick. The inner cylinder has at its higher end a feed

Germany Losing Grip on Iron and Steel Sources

RECENT advances in the West Make Her Hold on Great Iron Ore Deposits More Uncertain — Further Advances Will Put Her in a Precarious Position.

GERMANY Has Been Drawing Heavily For Her Supplies on Territory Which She Seized Shortly After the Outbreak of the War — The Steel Trade Watches the Move.

THE steel production of United States and Canada can hardly be increased. In fact it is apparently out of the question for any production figures to be attained that will be sufficiently in excess of what is being shown now to make any appreciable difference. The war needs of the Allies are away beyond the best capacity the steel plants of United States or Canada can hope to reach. At times the trade has been led to believe that it would be possible to have a surplus over war production to be distributed to the commercial trade. And just as often it has been shown that the production of the plants could not take care of the war programme. The commercial users of steel have ceased to look for relief as long as the war lasts.

The Next Best Thing

And so it is that the steel trade on this continent watches with compelling interest the advance of the Allied armies toward those parts of the western front that contain the steel mills and iron ore from which Germany has drawn the great bulk of the material with which to wage the war.

Germany herself is not rich in iron ore, but Germany, with the territory which she seized in 1871 in Lorraine, the land which she overran in 1914, and the domination which she has gained over the steel centres of France and Belgium, has been a greater producer of iron and steel in the war years than ever before. Germany had this well planned, and it has served her purposes to perfection.

Not only has it helped Germany, but it has handicapped France. When France lost the Briey-Longwy fields, she lost from 65 to 70 per cent. of her steel production, 85 per cent. of her iron ore supply, and 55 per cent. of her best mechanics

But In Spite of This—

Mancel Knecht, a member of the French High Commission in United States, and a native of Lorraine, in a recent address dealt most effectively with this very point, stating:

"But in the face of 1,500,000 of her men killed and as many more wounded, and 3,000,000 in occupied territory, she has been able, with the help of British coal and our own steel, to equip by June, 1918, with field guns, 20 divisions of the American army, meanwhile having helped Russia, Serbia, Rumania and other allies not only with prodigious quantities of munitions, but with officers to instruct and train."

The same speaker also gave statistics to show what Germany had gained by securing control of the iron and steel sources on that section of the continent.

In 1913, he said, the annexed part of Lorraine, which was under German domination,, produced 21,000,000 tons of iron ore. And the French part, which had not been taken by Germany in 1871, the part which has been occupied, nearly all of it, since 1914, produced in 1914 19,000,000 tons of iron ore. In the same year, 1913, the whole German territory, excepting the annexed Lorraine part, produced only 7,000,000 tons of iron ore. In the Lorraine district, he continued, we produced in 1914 48,000,000 tons of iron ore, and in your Lake Superior district in the same year there was a production of 52,000,000 tons.

In Lorraine and in Luxemburg there are resources of iron ore, he added, which will exist when there will be no more iron ore left in the Lake Superior district. "We have resources amounting to 5,330,000,000 tons of iron ore in those two little spots on the map of Europe."

He spoke particularly of the ore at Briey, and in spite of the depth of the mines and the necessity of unwatering them, the ore was obtained in 1913 for 4.69 francs or about 90 cents per metric ton. The importance of this deposit he emphasized in explaining that its output amounts to 76 per cent. of that of the Longwy-Briey-Nancy district.

Meanwhile France has been developing a rich iron ore in Normandy, and Mr. Knecht expressed a lively conviction that before long the much-talked-of tunnel under the English Channel will be a fact and French iron will go into England and France will be getting in return the coal she needs from England and Scotland.

Menaces Germany's Control

And so it is that the recent advances that push the danger zone nearer to Germany's control of the iron and steel sources are of unusual interest to this country. Robbing Germany of iron and steel is one grand master stroke. It means lessening Germany's supply of steels, of munitions, of guns—it means that where she fired two shells she may find it hard to find one. It means, in short, that Germany's power will be weakened. There is nothing surer than that.

The steel plants in Eastern France are mostly at Longwy, Briey and Nancy; in Belgium they are for the greater part near Charleroi and Liege. In German Lorraine, Thionville can be said to be the centre of the industry. The iron ore fields are fairly well distributed. In the north the ore is at Longwy for the most part, Briey in the more central territory, while to the south Nancy is the centre. About one-half the pig iron of Europe is made from these deposits, now almost entirely controlled by and operated for the benefit of the German war machine.

Germans Have It In Figures

Germany is well aware of the immense advantage that her early war operations have been to her. The Hun war machine has it all reckoned in stacks blown and tons produced. Before the Association of German Ironmasters in Dusseldorf, on January 30, 1915, Dr. Emil Schrodter, in an address, said:

"In France, Germany now holds parts of 10 departments, covering an area of about 5,250,000 acres with a population of 3,255,000. This means a German control of 68.8 per cent. of the coal output of France; 78.3 per cent. of the coke output; 90 per cent. of the iron ore; 85.7 per cent. of the pig iron output; 76 per cent. of the raw materials, including 95.3 per cent. of the basic Bessemer steel and 76.9 per cent. of steel castings, and the entire output of tubes. All but one of the French locomotive and railroad car plants are in German hands. For wrought tubes the French will have to rely on British and American supplies. Practically all of the French iron-ore mines are in territory occupied by Germany.

"Out of 170 French blast furnaces, 95 of the 127 in blast when the war broke out are in the war zone. Because of ore scarcity only 30 of those still in French hands are able to run, and many of these are small. Hence 80 per cent. of the total French blast-furnace capacity is out of commission. Of the French steel plants 70 per cent. are in German hands. Steel plants uninjured are largely idle. At the horse-shoe works at Valenciennes enormous stocks were found and appropriated by the Germans."

Summing up as to France, Dr. Schrodter said: "While we on the German side are able to draw upon enemy stocks, the French army is deprived of the greatest part of its manufacturing resources and has to get its material from foreign countries. Hence France has already been so severely hit as to cripple and partly destroy her economic power."

Germany Fears It, Too

And so it is that Germany seeks to secure iron ore from Sweden. Sweden has the ore, and it's good ore, too, but Sweden depends on the Allies for a good many supplies. So if Sweden choses to sell iron ore to the Hun the Allies may be inclined to cut off certain supplies without which Sweden would be in a sorry way. And so Sweden may hesitate, and the chances are that she will.

The American advance that wiped away the salient at St. Mihiel means much. Germany knows what it means, and the steel trade knows what it means. And every move that brings the Allied forces closer to Briey means that Germany is going to lose the power that she has gained from stolen iron. The progress of the battle is interesting. There's more in the outcome than a few miles of territory. Without iron and steel Germany or any other warring nation is beaten hands down, and the day when Germany is going to lose her grip on the iron ore deposits and the blast furnaces of France is coming very close. Watch it.

TORONTO MAN BELIEVES HE HAS NOW SOLVED THE MAKING OF THE CAST SHELL

A SHELL that would require no machining of any kind, but would come from the mould practically ready for filling, would reduce the cost, and increase the output of shells enormously. If this shell should be cast from a mixture of semi-steel that made a metal of perfectly homogeneous structure, with an even distribution of its component parts, and giving high tensile strength, a revolution in shell making might be anticipated.

Such were the thoughts animating J. C. McLachlan, of Toronto, when the shell industry was getting well under way in the first year of the war. He began to work on the idea about three years ago, and first experimented in moulding, to overcome the difficulty of keeping the core perfectly central in the mould, to ensure the walls being of even thickness. This was not achieved without a long course of experimenting, but finally he succeeded in turning out a perfect shell. Then began the usual vicissitudes of the inventor, the British Government were approached first of all, through their Canadian agents, but they promptly turned their eyes against it, as they would not consider any shell made from cast metal, their objection being that a casting would not stand the shock of the firing charge, resulting in the shell bursting as it left the gun.

Given A Test

Mr. McLachlan succeeded in getting the ordnance department in Quebec to make a practical test, by firing some of the shells, the test demonstrating that the shells could be fired without any danger of fracturing. Nine shells in all were fired, and afterwards recovered, none the worse for their trip. About this time the inventor was getting in touch with the U. S. Government, and incidentally, got in touch with the German spy system.

How Germans Worked

The U. S. had not yet got into the war, but Mr. McLachlan received a message from a man in New York, offering him all his expenses to go down there and demonstrate the making of an 11-inch shell. As he did not wish to go to the States at the time, he suggested his correspondent should come to Canada. This met with refusal at once, and offers of still more liberal treatment. Finally he decided to go and see what was doing. He met his client, who called himself Grey, and was dressed in the height of fashion, and carried as much ready money as the Bank of Montreal. Mr. McLachlan was entertained royally, and it was arranged he should get the use of a small foundry cupola, and make an actual shell. While arranging for this, the U. S. declared war, and Mr. Grey vanished. It was then that Mr. McLachlan found that the Allies did not use 11-inch guns, but the Germans did.

French Government Using Shells

Mr. McLachlan submitted his shell to the French Government, and they tried it out successfully, and have been using it in considerable quantities for some time. Mr. McLachlan has not as yet made anything financially from his invention, but he is not worrying over that. The U. S. Government have now taken up the shell, and have drawn up specifications and sent them out broadcast to Canadian as well as U. S. foundries. It is therefore quite likely that in the near future the manufacture of these shells in Canada will be an accomplished fact. Probably the British Government may then look further into the matter.

N. A. S. E. Outing.—As usual the Lunkenheimer Company of Cincinnati, royally entertained the delegates and visitors of the N. A. S. E. national convention held in Cincinnati during the week of September 9. The company obtained permission to use Cincinnati's wonderful Zoological Gardens on Wednesday afternoon and evening for their outing, and, judging from the large attendance every one visiting the convention was present. Amusements of all kinds were arranged for by Lukenheimer representatives. The vaudeville was particularly enjoyed, especially the ice skating upon the only outdoor artificial ice skating rink in the United States, the performers being the very best that the profession afforded and were brought from Chicago solely for this affair. Amusements, cigars, drinks and an excellent dinner were all furnished gratis to the delegates and their friends by the Lukenheimer Company. Over fifteen hundred people were dined and all were greatly surprised at the order and despatch with which the meal was served. It was the consensus of opinion of the delegates and their friends that the Lukenheimer outing made the 1918 convention one of the most enjoyable and interesting ever given, and one long to be remembered.

Quebec.—It is stated that a company in Quebec is considering the building of thirty wooden vessels, of five thousand tons each.

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British Labor Favors Tariff Reform.

JOHN HODGE, British Labor M. P., and Minister of Pensions, told the Iron and Steel Trades Confederation that if the Labor party were pursuing the policy of Free Trade as it had existed prior to the war, his connection with the party must cease. To him the war had demonstrated very clearly the need for an economic change. Speaking from an intimate knowledge of the steel and iron situation, he expressed the opinion that he was not inclined to let any steel into Britain as long as there was an idle furnace. He was also out of touch and sympathy for that section of the Labor party which declared for no annexations and no indemnities.

John Hodge was not a tariff man before the war. To him the policy of free trade was correct and sufficient. But he is able to see and recognize changed conditions. He does not hold to a theory in preference to recognizing a fact.

John Hodge may have a lone furrow to plow for a few turns, but the same serious circumstances that pointed out the need of a changed policy to him will point the need to others. Making Britain the dumping ground for the over-production of all the world is poor stuff for an after-war policy.

Coal Situation East and West

THE miners in Pictou county, N.S., are out on strike, and have been since early in September. In district 18 of the U.M.W. of A., which takes in Alberta and British Columbia, a strike is likely in a large section of that country, as there is a dispute which has not been settled between the miners and operators.

This, with winter only a few weeks away, and with tremendous demands being made for coal for war industries and other purposes, presents a mighty poor lookout.

The mining of coal in Canada is a poor index of the coal that could be mined in Canada.

Western Canada has a coal wealth that should make her prosperous the year around. The southern part of British Columbia should be busy and developing all the time. It is not. About half the time it is tied up with strikes. On operation and tie-up it looks like a fifty-fifty proposition.

There is a foreign element in Western Canada that is making trouble. That element is feeling its power to-day as it has never had a chance to do before. It is bluffing the whole Dominion, and especially the West. It is playing fast and loose with the big question of supplying Western Canada with coal this year.

In the East the situation is hard to understand. That district has not had to deal with the foreign element to the same extent as the West, and yet, with industries there calling for coal for war work, and with a known shortage facing the whole district, the miners ignore their contracts and refuse to work.

The Department of Labor has not shown itself big enough to deal with these matters. It approaches them with a timidity that is humiliating and dabbles with matters with a ten-foot pole that should be taken up with the bare hands of determination.

A Bit of a Sermon

SOME folks is makin' money now they never dreamed before, and where they used to earn one bone, by heck, they're gettin' four.

Some chaps I knew not long ago could hardly chase around, to raise the coin 'bout twice a day when eatin' whistles sound—they lived close down unto the ground, they were all in by noon, because at fodder time they had a shoe string and a prune.

They only had one suit of clothes to spread upon their skin, and that there suit was worn, it was, until 'twas mighty thin.

They had some patches on the coat, some pieces in the vest, it was a shame, by jing, it was, to call it Sunday best—and there were hunks of cloth nailed on of many hues and slants, to decorate the garments that bore the name of pants.

But all them things is changed, they is, there's money now to spend, and they're clothed in rags what's mighty fine from front unto the end.

They used to smoke a bum cigar that smoked just like a stump, and labelled him what puffed it a lobster and a chump—but nowadays they use the stuff that's wrapt in silver foil, you'd never think they used to be a lowly son of toil.

But when these times is on, me boy, just think about the change, just sit some night and put your feet upon the kitchen range, and see if you ain't goin' dead wrong to spill your wad like that—you'd better give your brains a chance what camp beneath your hat.

So when the cash is comin' thick, when pay day's growin' fat, look past the end of your old snout to days what may be flat; just take a ten spot now and then and put it down to soak, against the day when your good thing may be all warped and broke.—ARK.

A man may not have much of a tooth in his jaw for oleomargarine, but when butter's touching the 60 per mark and oleo hangs around the 35 shot, the chances are that said oleo will be given a box seat at the kitchen table performance.

* * *

Toronto school board finds that it can't enforce the regulation for children to salute returned soldiers. The chances are that a square deal from all concerned would be much preferred by the soldiers to all the manoeuvres that the youngsters could shake out of their carcasses.

* * *

The Kaiser started the war with six sons, and the family roll call shows them all above the daisies yet. It's a caution how this half-dozen war scarred veterans dodge bullets. The next big job for the Kaiser will be to save enough out of the wreck to provide for his sons. Guns aren't shootin' far enough to hit 'em.

* * *

The government paper investigation is calling Canadian publishers to meet at Ottawa on October 16, to consider how the use of newsprint can be curtailed. The suggestion is made that comic supplements should be cut out. That's all right, but if that's done some of them wouldn't be worth buying. The juvenile circulation would shrink to nothing at all.

YES, THERE'S ALWAYS ROOM AROUND THE TOP

Interesting Experience of Man Who Secured His Education After He Left the School House

By H.A.T.

SATURDAY evening of last week I had a talk with Fred J. Milne, mechanical superintendent of the Pure Gold Manufacturing Company. In relating his experiences he impressed upon my mind certain pictures, and I cannot do better than let his words reveal these to you, after I have disposed of a few attendant particulars.

FRED J. MILNE

Fred. Milne was born in the city of Toronto on the 28th day of July, 1881. His parents moved to the United States while he was still a very little boy. All the school-given education he received was that imparted by a public school in Buffalo, N.Y., and another in Dayton, Ohio. Add that he earned as he learned; that he was, in fact, the first boy in the messenger service of the Western Union to own a bicycle—a bicycle that he himself built by giving a semblance of the vertical to the outward-spread rear forks of a tricycle, shortening the rear axle and discarding the surperfluous wheel; add, also, that at the age of twelve he was an apprentice in the Dayton Computing Scale Company's plant, and you have a fair idea of the educational equipment with which he set out to best the mechanical world.

At this time, as chief engineer in the plant of the Dayton Artificial Ice Company, the lad's father was making 321 tons of ice every 24 hours—something to talk about years after 1893. So possibly this proud, but cold, record, and the ice plant's battery of 12 boilers and a pay envelope by a few bits of silver fatter than $1.50 a week may have jointly conspired to attract the boy; or possibly, remembering the lad's age, to "work with dad" was inducement enough. Certain it is that young Milne moved from the scale plant to the ice plant before his full time as an apprentice in the former had been served. And for two years following, in the ice plant and in the Lockland Woollen Mills, he worked to good advantage under his father.

"I was turning 13 when I went back to Buffalo and apprenticed myself to the Rogers Company. Their shop made circular saw sharpening machines. The foreman was a big German.

"In that shop we had to forge and draw all our own tools.

Where He Met the Hun

"Even our flat drills we had to make from diamond steel. Many a day I shaped a tool on the anvil, under a hammer that was a sledge to my strength. And that big GerHun stiff stood near and timed me. And more often than I like to recall he towered over me and my lathe.

"'You'll do it right, damn you!' he'd say. And then he'd stand and curse for half an hour at a stretch, while tears rolled down my cheeks and fell as coolant on the casting in my lathe. Only they were hot tears.

"But I stayed with it—and him—until I had served my full time as an apprentice—sixteen months in that shop.

"The day after my time was up I was working for the West Tool Machine Company, of Buffalo. In this shop we made tinners' machinery; that is, machines for cutting tin, crinkling galvanized sheet metal, etc. I wasn't a great while in this shop nor in the next. For the old folks were returning to Canada, and I wanted to go along.

"I did—as far as Hamilton. Here I took the first job that offered—making catsup and boiling strawberries for the Simcoe Canning Company.

"Not on a bet, to this day, will I eat a preserved strawberry. And in spite of the fact that I burned up a whole kettleful of them, after almost 72 hours on the job without sleep, I was the last one paid off at the season's close.

"I'll not forget that winter. It was hard and times were bad. I wasn't more than 15, and out of a job. As weeks passed, and no work could be found, things became desperate for me. I decided to make work—and money.

"I built a hand sleigh and on top of it rigged up a stove out of a link of old stove-pipe. Then I spent one dime for a bag of charcoal and another—the last I had—for acid. I had a soldering iron and a bit of solder. So I built a fire in the stove and started out as a tinker, prepared to mend old pans and kettles.

From house to house I went in the outskirts of Hamilton—in the outskirts because I had neither a license nor the price of one.

The Going Was Hard

"But holey pans were scarce that day. The only thing that wasn't scarce was trouble. My sleigh overturned and caught fire. I put the fire out with snow, gathered up the spill and trudged on to the next house. There I got my first job—a leaky sauce pan and a boiler.

"I rebuilt the fire, heated the soldering iron, got the acid handy, and set to work. But I couldn't make the solder stick. I worked for a long time. It wouldn't stick. And there was a good reason for that, as I finally discovered.

"The acid must have poured out at the time of the spill, for the liquid left in the bottle, only a few drops, was snow water.

"After that venture I got to Toronto—some way. For a time I was cash boy in the window shade department of Eaton's. Paid $2.50 a week. Later I worked in several plants here, both before and after I went to 'the woods.'

And in one of these particularly—the power plant in connection with the W. A. Murray store—I got useful electrical experience."

Mr. Milne explained that by "the woods" he meant the village of Wilberforce, at that time named Pusey. Here he joined his prospective father-in-law in a wood-cutting industry that did not prove so successful as it might to-day. And here, too, he was engineer in the Thomas Beck saw mills.

Eleven Years Ago

"It is now 11 years since I started in the Pure Gold plant as engineer," he continued. "I've seen it grow to its present size, and I've installed all the mixers, those great hydraulic presses, all the electrical power equipment—practically every machine operating in it to-day.

"I was promoted to mechanical superintendent a little over one year ago.

But his story would not all be told if I stopped without mentioning that his salary would make many a petty executive envious, any more than it would all he told if I failed to say that his son is a clever apprentice in the plant of the Consolidated Optical Company, or that his little girl, musically gifted, is being trained by the Toronto Conservatory of Music, or that the good mother looks as young as her children.

And still another thing I noticed—a library of 15 to 20 mechanical and electrical engineering textbooks. These books Mr. Milne has had for about 11 years. That fact, considered with all that precedes, seems to CANADIAN MACHINERY to be very significant.

MARKET DEVELOPMENTS

Cutting of Non-Essentials Improves Situation

Phonographs and Passenger Autos Will Not be Made in United States After First of the Year—Government Places Very Large Order—Equipping the Canadian Expedition That Leaves Soon For Siberia

CANADIAN dealers who have been in the United States market looking for machine tools report that the biggest concerns there are not looking for business. As a matter of real fact selling has ceased to be part of their business. It is now simply a matter of production and leaving the disposal of the material to the government. Some idea of the volume of business moving can be gathered from the following. The manager of a large Canadian firm was in Cincinnati where he wanted to order a dozen electric drills. At the same time he was in the offices of the company there came an order from Washington calling for delivery on an A-1 rating of 600 of these same tools. The government controls the situation absolutely.

There are still delays in the equipping of Canadian plants that are preparing to take on American war orders. In a couple of cases there is not a little embarrassment following the delays. A large amount of the capital has been put into plant, and the government allowance in the way of advances has been used, while a large overhead remains to accumulate against the day when there shall be deliveries to balance the account. Every effort is being made to relieve the situation, but it is quite a distance from being satisfactory yet.

The war continues to make all sorts of new calls on the machine tool equipment of the country. This week agents are busy gathering up a list of machine tools for the equipping of the Canadian force that is going to Siberia. This force will run into facilities for repair and upkeep work that will be poor or of a zero quality, and for this reason the necessary equipment for shop work is being sent along with them.

Canadian trade is looking for something better in the supply of plates than has been coming to this country for some time. The United States has been cutting off so many of the non-essential users that there is bound sooner or later to be an improvement in the situation. Every week sees a cut made in the list. This week it is announced that the U.S. War Industries Board requests the manufacture of passenger automobiles and phonographs to stop by the first of the year. In the latter case it is not the amount of steel that is thought of, but the inroads that the business makes on the labor market.

SHIPBUILDING BECOMING THE CHIEF INDUSTRY AT MONTREAL

Special to CANADIAN MACHINERY

MONTREAL, Oct. 3.—The volume of business that is being carried on throughout the industrial field to-day is confined to the amount of material that can be delivered to carry on this business. As a matter of fact it is this feature that virtually controls the general situation. Regarding machine tools the time of delivery is the factor that determines the price, as the latter is based on the market at the time of shipment rather than a fixed price at the date of the placement of the order. The demand for tools of a general description has been additionally heavy of late and dealers are unable to satisfy the requests of the manufacturers, as the builders are unable to construct the necessary equipment in the time specified, and unstated delivery must necessarily be a feature of an accepted order.

It is understood that a quantity of the 12 inch shell is included in the recent large contract received by the Canada Cement Company, and a factory for the production of these shells is now under construction at Rockfield, P.Q. A report, which has virtually been confirmed, is to the effect that the manufacture of a cast iron shell for the U. S. government will soon be taken up by the munition makers here in Canada, and it has been intimated that negotiations to this end have been under way for some time. Shipbuilding has been making good progress here and plates for steel vessels are coming along regularly with the yards amply supplied for maximum operations. Yards working on wooden boats have experienced a little delay in obtaining lumber for the superstructures. This situation, however, is less acute at present as shipments are much better.

Steel To-day Means Shipbuilding

When summing up the activity in steel at the present time the situation could be explained in the one word—shipbuilding. The importance of this industry has overshadowed every other enterprise and the requirements for ship plates must receive precedence over every other demand. One local dealer traveled to Ottawa to see what could be done regarding some steel plate for general industrial requirements, as many local concerns were urgently in need of material for plant repairs, but little success resulted from his efforts as he was told that unless the plates were required for steel ship work, his request would receive little attention from the War Trade Board. This feature of the existing situation was additionally emphasized by another steel producer here when he intimated that it was very difficult to obtain the necessary material for the making of wrought iron pipe. In explanation of this the manufacturer stated that the same mills that could produce the blanks for the large size pipe could be utilized for the production of ship plates, and the heavy requirements for this material allowed little tonnage to be produced for pipe purposes. The volume of output devoted to the making of pipe was therefore confined to the short periods between the ship plate rolling process. It will be noted that the latest price list (37) on wrough iron pipe incorporates a slight change in the method of quoting prices. In previous lists the quotations for standard lap-welded pipe have been based on a price of so much per hundred feet. The changes going into effect with the latest list are on the old basis for pipe up to and including 4 inches diameter, larger than this, or up to 10 inches, the quotations are made at so much per foot. The prices of lapwelded pipe have advanced in the recent list and these changes will be seen in the selected market quotations. In nearly every direction the steel situation is feeling the pinch of ship-building and shell requirements, and little material is available for other purposes unless it can be clearly shown that such needs are in keeping with the essential regulations of the War Trade Boards. The co-operation of the two governments in this respect is so close that nothing can be obtained without the sanction of one or both bodies.

Market Being Eliminated

The general market is being more or less influenced by the price fixing that has featured the American situation during the past summer, and this has been a factor in establishing the prices that are now effective in this market if it can be said that a market really exists. Regulations under which all transactions are carried on has virtually eliminated the old time market, when price fluctuations were largely a factor of current developments. With the actual supply being devoted almost exclusively to war requirements and these requirements allotted by the War Trade Boards of the two countries, the changes of quotations are invariably set at certain periods and any changes are determined by the conditions existing at that particular time. To obtain material at the present time it must be shown that the purchaser is operating on essential war work or that directly associated with it. Unless this is so it is next to impossible to secure material. The copper situation is unchanged and prices are firm. The easier position in tin has been reflected in lower price quotations and dealers anticipate a still lower level in the near future. Local prices have declined to 95 cents per pound. The lead situation has taken on a more acute tone in the States, and as a consequence the market here has been affected; no American lead can be shipped to Canada at present and this may shortly result in a stronger market here. At present the demand here is not excessive and the prices remain firm.

Spelter demand is very quiet just now and the situation is easier but as yet price quotations are unchanged. These remain at 10¾c per pound. Through a printer's error the Montreal quotation for spelter last week read 16¾; this should have been 10¾c.

Heavier Tools Hard to Obtain

Machine tool requirements are still of sufficient volume to maintain the interest of dealers but the possibility of acquiring certain equipment is evidently as remote as ever. One dealer here states that it is next to impossible to secure equipment from the States, particularly lathes of a size greater than 25 inch. Where it is possible to place orders for machinery of the standard type nothing like prompt delivery can be obtained, as shipment cannot be guaranteed under six or eight months, and in some cases even longer. One dealer here had a testing machine recently, and while negotiating with the I. M. B. for its disposal, intimated that it would be difficult to obtain a similar machine from the manufacturers under three or four months. The official of the board replied that delivery could not be expected before a period of at least eight months.

In an effort to secure a greater volume of machine tools of a general character both those that are now on order and some additional equipment required for customers, another local dealer has left for the States to gather together as many tools as he can. If he can locate the same he is hopeful of securing permission to have them shipped through at an early date. Tools of a standard character are the hardest to obtain, this particularly applies to boring machines and milling machines. The recent placement of a large munitions contract here for the American government includes a shell of the 12 inch variety and considerable inquiry for suitable tools has recently been made to dealers.

Scrap Shows Little Activity

Dealings in old materials is not marked by any pronounced activity, and what market there is now left for the dealers is very quiet in character. The situation to-day is virtually in the hands of the government and the bulk of the business is done direct through the producer and the consumer with the aid of the Imperial Munitions Board. Considerable demand is still evident for machine cast iron and malleable scrap but the supply is apparently light and the market in this respect is quite strong. Old metals have weakened during the past week, but little more than a normal business is reported. New brass cuttings show a decline of ½c and are now quoted at $15 per hundred pounds. Red brass turnings show a similar decline and are now quoted at 18c per pound. Dealers are now asking 9c for light brass, this quotation being one cent lower than that of last week. Malleable scrap is comparatively scarce and quotations have advanced to $25 per ton, a rise of $4 during the week. Machine shop turnings have advanced from $8 to $9 per ton. Requirements for stove plate have become easier and the price is easier by $2 per ton, the current quotation being $30 per ton.

POINTS IN WEEK'S MARKETING NOTES

Coal miners have been on strike in Pictou County since September 16, and there seems small chance of them returning to work.

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Makers of machine tools at many United States points are so far behind in deliveries that they are not looking now for any new business at all.

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Dealers report that there is a fair amount of machinery scrap coming into the market now. There is a large surplus of brass and copper in the yards.

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Some of the pig iron furnaces claim that at the new rate of price recognized by the government they are not making any money.

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United States War Industrial Board wants the manufacture of phonographs to stop by the first of January by reason of the number of hands employed in that business.

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More hopeful reports are handed out from Pittsburg regarding the steel supply. It is likely, on account of the number of non-essential lines that have been cut off, that the shortage of steel plate will be relieved.

WAR BOARD KEEPS KEEN EYE ON ORDERS

Dealers Believe That Plate Will Be In Greater Supply Before Long

TORONTO.—The securing of delivery of machines is one of the biggest matters that the machine tool trade has to deal with just now. It has been a serious item for some time, and the chances are that it will continue so. In fact there are a couple of cases in which considerable embarrassment is being caused because plants are not in a position to go ahead and produce shells, while at the same time they have to keep up a good-sized overhead charge against their plant. Dealers who can get machines can sell them if they can do war work, and it looks as though this condition would continue for some time to come. Some of the later contracts that are coming out now in the making of gas shells, which is largely foundry work, contain a cancellation clause, in case the war shall be done by a certain date, but, of course, the firms undertaking the work would be protected in case such a thing came to pass.

The Steel Trade

The War Board, at Ottawa, is getting to the stage where it can turn down orders and cut them pretty close in order to keep the allotment of steel coming to this country centred entirely on war work. For instance, one of the large public utilities of the province sent in an order for plate during the last week. It was returned to-day, and will not be filled. The plate was not for any specific purpose, but simply to keep up the warehouse stock for repair purposes. Canadian warehouses are getting quite generous shipments of material that is of the lighter gauge, but on material that comes within the scope of the Canadian allotment they are not receiving such generous treatment.

The Matter Of Price

There is quite a big gap between the prices at U. S. mills and the prices that are now recognized in Canada. The trade seems to think that if the governments of both countries stepped out of the way and allowed the steel situation to work out its own level there would be changes on both sides of the line. The Canadian market would be due to come down and the U. S. price might advance a bit. At present plate costs $7.50 at the mill, which is at the rate of $150 per ton. On this allow $10 for freight and handling and you have $160 plate in Toronto. The American price is $3.25 at the mills, which is $65 per ton. To this add $3 duty and $5 freight and it gives plate from the U. S. mill laid down here at $73, against the present Canadian price of $160. In competitive times this difference would have to be taken up quickly. The Canadian price would not have to meet the existing price in United States, for the trade seems to think that steel will find its level around $4 per hundred, which is a fair lift over the present set figure of $3.25.

Scrap Yards Full

Quotations for copper wire are off $1 this week. In fact all grades of copper scrap are weaker and are not moving as rapidly as usual. Previously all, or nearly all, the copper scrap used to be sent to United States points where it was used and turned back to No. 1 electrolytic copper, but now that there is an embargo against the shipment to that market there is a considerable quantity accumulating in this country, and as soon as stocks reach a certain size there is bound to be more or less reaction. Dealers claim that that stage has now been reached. The surplus stock of copper and brass of all kinds will increase if the embargo keeps up. The most of the copper scrap continues to come from the domestic utensils gathered by the country scouring of the metal wagons. Since the munitions business began to operate there has been a considerable amount coming from the bands, but the bulk of the matter that reaches the yards comes from the collectors all over the country.

There is also a fair amount of machinery scrap in the yards just now, which is quite a contrast from the conditions that have been general for some time past. In fact several of the dealers hinted at a lower figure for machinery scrap. There is enough on hand for the consumers to use now, and there seems to be very little tendency to buy very far ahead. There has been quite a lot of scrap coming from the west and other points.

PASSENGER AUTOS AND PHONOGRAPHS TO BE CUT OFF THE PRODUCTION LIST

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Oct. 2.—Through the combination of stimulating production and curtailing the supply of steel at all points to the actual needs of war activities, instead of looking to the creation of possible reserves, production and requirements may make a more even break at the end of the year than has been in prospect from the figures so frequently mentioned by the War Industries Board. First, early in July, the board placed the half year's requirements at 20,000,000 net tons of finished rolled steel, intimating that there was no likelihood of more than 16,500,000 tons being made. Later it increased its estimate of production to 17,000,000 tons, while by successive stages it advanced the requirements to 23,000,000 tons and then spoke of the possibility of 25,000,000 tons being made.

Production in the past three months has been fully 9,000,000 tons, and as the period included the hot weather, which always curtails output, while strenuous efforts are being made to increase production, the output in the next three months ought to be more than 10,000,000 tons rather than less. The September report of steel ingot production, which should be available within a fortnight, will give an inkling of the autumn pace in steel production.

Curtailing Steel Supplies

The War Industries Board has announced a large batch of steel curtailment arrangements made with various consumers, from the makers of clothes wringers to the makers of phonographs. On an average, the restriction during the last four months of the year is to be one-half the output in the corresponding period of 1917. It is desired that the manufacture of passenger automobiles and phonographs cease entirely January 1. Except in the case of a few items, not much steel, in point of tonnage, will be saved by this curtailment in industrial operations, but there will be a very important saving in man power. In the case of tin plate conservation, the work is being done by the Food Administration which has been making agreements with the packers of non-perishable food products to curtail their consumption of tin plate, or stop it altogether. As recently reported, a curtailment in tin plate production for the fourth quarter to 70 per cent of the former rate was ordered, but this conservation program is expected to make feasible a still greater reduction.

The War Industries Board, besides seeking agreements with ultimate consumers as to restriction in steel consumption, is also negotiating with the finished steel producers themselves, looking to a curtailment in their consumption of raw steel. The pipe mills, for instance, have been asked to consider whether a reduction in their output would cause difficulty in any important war activity.

A very important point in connection with all this steel conservation work is that it is not directed towards the saving of steel for the purpose of putting the steel into some particular product or channel of consumption. Except for the item of rails, it is not definitely shown that the supply of steel is distinctly short in any direction, at least with respect to any considerable tonnage. To illustrate this point, the case of shells may be taken. It is quite clear that there would be no desire to save steel at the expense of shells. Nevertheless, the supply of shell steel has been scrutinized, not on the basis of how many shells the prosecution of the war requires, but on the basis of how much shell steel the forge shops can actually work. Ship steel has also been studied. No statement has been made as to how much, if any, steel has been found that can be taken out of these programs, but it is hinted from Washington that a new and revised estimate of the half-year's steel requirements may be forthcoming.

Pig Iron Prices

No particular effort is made to disguise the fact that the revision of pig iron prices for the fourth quarter of the year was dictated entirely on grounds of expediency. Some furnaces were making little, if any, money and it was desired to relieve them. A general and large advance could not be considered, and a schedule was worked out which is not logical but which is perfectly practicable, and which gives an increased price to the furnaces that have had the highest costs. Eastern Pennsylvania is put on a Pittsburgh basis, while Tennessee and Virginia are put on the Birmingham basis. As Lake Superior ore was advanced 25 cents, basis prices were advanced, but only on basic and foundry, forge and Bessemer being left unchanged. The ore advance of 25 cents would mean about 45 cents increase per ton in the cost of making pig iron, and the grades that are advanced $1 a ton comprise about three-fourths of all the iron that is sold, being therefore equivalent to an average advance of about 75 cents, and giving a net advantage to the furnaces using Lake Superior ore of say 30 cents. Furnaces using local ores, which are not changed, get the benefit of the full pig iron advance. The additional advantages given by reason of the removed basing points amount to 75 cents to $1 in the case of Tennessee furnaces, perhaps $2 to $4 in the case of Virginia furnaces, and possibly $1 to $3 in the case of eastern furnaces. The lake front furnaces will sell f.o.b. furnace as formerly, and as pig iron required by Canada will doubtless be allotted to them, the only practical interest to Canada in the price revision is that basic and foundry iron will be $1 higher than formerly.

There are wider differentials for silicon irons, and this applies even to No. 1 foundry, which is now $1.25 above No. 2 instead of 50 cents, the dividing line being 2.25 per cent. silicon. Buffalo and eastern Pennsylvania No. 2X is above 2.25 per cent, while No. 2 plain is 1.75 to 2.25 cent.

Basic Eight-Hour Day

The iron and steel industry as a whole will adopt the "basic eight-hour day" which the Steel Corporation announced it would make effective in its plants October 1. There has been so much argument in the past year or more about "the basic eight-hour day," much of it ignorant, much of it selfish, and not a little of it decidedly intemperate, that it might be supposed the news that it is being adopted by the iron and steel industry is regarded as of tremendous importance. It is, however, nothing of the sort. The change does not make a ripple in the industry's affairs. Hours of labor are not affected. There is merely a little change in the payroll clerk's arithmetic. Formerly, when a man worked 12 hours, his pay for the day was 12 times the hourly wage rate. Now it will be 14 times. The ten-hour man will get 11 times the hour rate instead of 10 times, for the hours beyond eight are to be paid time and a half. One is a wage advance of 16 2/3 per cent, the other an advance of 10 per cent. Men working eight hours get no advance at all, by the new system, but a little advance may be given some of them. The total increase in payrolls will hardly average 10 per cent. This is the eighth wage advance since the war began, the first being on February 1, 1916. Six were of 10 per cent. while one was of 15 per cent. As to hours of labor being reduced, and the total volume of man power for making steel reduced, the plain fact is that the 12-hour men have wanted to work the 12 hours. When they are paid a bonus for the hours above eight, they will be still more anxious to work them.

BIG CONTRACTS OUT FOR SEMI-STEEL SHELL

U. S. Government Sends Out Call For 33 Million Gas Projectiles

Special to CANADIAN MACHINERY

NEW YORK, Oct. 3.—To carry out the impressive program of the War Department for a vigorous prosecution of the war, several hundred million dollars more must be spent in the purchase of machinery for the manufacture of guns and ammunition. The request recently made to Congress for a deficiency appropriation of $7,000,000,000 emphasizes the enormous work that must still be done in providing war material. The Ordnance Bureau alone will require several billion dollars for artillery and for shells of various kinds. Contracts are now being distributed for small arms and additional orders have been placed for semi-steel shells. For the 33,000,000 semi-steel shells required it is estimated that about 140,000 tons of pig iron and about 60,000 tons of steel scrap will be needed. In the last week orders for about 36,000 tons of malleable pig iron for such shells were placed and other large contracts are pending. It is the intention of the Ordnance Department to obtain the assistance of about 150 small foundries throughout the country to take on such work. Manufacturers are also being sought who can produce trench mortar shells of light type for carrying gas, smoke and illumination.

In the last week buying of machine tools in the eastern territory has been confined to small lots. In the interior buying has also been of relatively small lots but in the aggregate the volume of business has been heavy. Several large contracts for shop equipment are still pending, the largest inquiries coming from the Ordnance Department for the Neville Island gun and projectile plant being built by the United States Steel Corporation.

Some Big Deals

Purchases are now being made against a list of 318 cranes. The Midvale Steel & Ordnance Co. is about to put out a list of heavy tools required for equipping a 12-inch howitzer plant at Nicetown, now that purchases for the 16-inch howitzer plant have been completed. The Watervliet Arsenal has bought additional tools costing about $100,000. The General Ordnance Co., Derby, Conn., has purchased tools for manufacturing guns to equip hydro-airplanes. The Rock Island Arsenal is about to ask bids on $250.000 worth of forging and other shop equipment. The Kohler Co. has bought machines for making shells.

The Ordnance Bureau of the War Department has established a new division under the direction of Captain John Turner. formerly of New York, to supervise all ordnance equipment purchases and there is a possibility that all buying of machinery for ordnance contractors will be centered in Washington. The Bureau has also placed several additional contracts for light arms. The Burroughs Adding Machine Co. has taken a contract for pistols and two similar contracts are pending at Philadelphia. Several small manufacturers in the east are buying tools for making fuses and nozzles for flame throwers.

The General Engineer Depot in Washington has been buying machinery quite heavily for installation in locomotive round houses in France where a great deal of repair work is done. The Yale & Towne Manufacturing Co., Stamford, Conn., and the United Injector Co. of Boston, have purchased tools for making nozzles and injectors. The Towle Manufacturing Co., Newburyport, Mass., previously manufacturing silverware, has taken on a contract for gas buoys and parts of gas masks.

The Lake Torpedo Boat Co. has put out an inquiry for $300,000 worth of machine tools to increase output. The New York Shipbuilding Co. has given a contract to build a plate and angle shop to replace the buildings recently destroyed by fire, in which they sustained a loss of $300,000 but the company continues to operate full capacity, about 40 ships being under construction. At the shipyards being operated by Pusey & Jones hereafter only 12,000-ton ships will be built and the five shipways at Gloucester City are being combined into three large berths for the building of the larger type boats.

NEW PROCESS FOR SHELL NOSING

Canadian manufacturers are keeping to the front in the development of munition machinery of all kinds. A recent development being perfected at present promises to effect considerable improvement in the method of nosing in shells of all sizes. We are fortunate in securing data regarding this development and promise a valuable feature in the near future.

MAY CATCH TONNAGE BY THE FALL OF 1922

Chairman of Shipping Board Tells Something of the Work Being Done

Through the efforts of American shipbuilders the nations fighting Germany have broken "the backbone of the submarine campaign," Chairman Hurley of the Shipping Board said in an address before the Philadelphia Chamber of Commerce, opening the fourth Liberty Loan campaign. He predicted the national marine tonnage will be restored by the fall of 1922 or earlier.

"Every plan, every prediction, made by the German government has failed," Mr. Hurley said. "As the British fleet bottled the Germans in the Kiel Canal, as the brave French held the Germans at the Marne, the shipbuilders of America have dashed for ever the hope of Germany to isolate this country and prevent its participation in the war of humanity against despotic military power."

Allied Ships Made it Possible

Despite the enormous expansion of the shipbuilding industry, Mr. Hurley said, it had not been possible to provide the tonnage necessary to transport the American armies to France and maintain them there. Credit should be given, he asserted, to England, France and Italy, who though "short of ships themselves made further sacrifices in order that we might easily get nearly two million American soldiers to the battlefields in the first year and a half of our war against Germany.

"War has produced a community of interests among the Allies and America and it is only by the unselfishness of each that all can be assured of victory."

PICTOU COUNTY MINERS GO OUT ON STRIKE—A BAD SITUATION

Special to CANADIAN MACHINERY

SYDNEY, N. S., Sept. 30.—The coal-miners of Pictou County have been on strike since the 16th September and at the time of writing there is no likelihood of them returning to work. The action of the miners is incomprehensible and indefensible, inasmuch as it is in direct contravention of the agreement with the operators. Following the lead of the Cape Breton miners—who are organized in the Amalgamated Mine Workers of Nova Scotia—the Pictou miners—who are members of the American Federation of Labor—agreed to a wage adjustment in the spring, subject to review at the 1st of July to conform with any appreciable increase which might in the meantime have taken place in the cost of living. In Cape Breton, after some negotiation, a figure of twenty cents per day was agreed upon as representing the amount required to compensate the men for the increases which had taken place, and a wage increase of this amount has been arranged. In the case of the Dominion Coal Company, certain additional adjustments were made as between the wages of the machine-runners and their helpers, which were intended to more equitably distribute the wages paid to these two classes of employees. In any case the agreement between the men and the companies in Cape Breton was loyally lived up to by both the men and the companies.

Sent Ultimatum

In Pictou County the operators offered the men the same increase as had been arranged in Cape Breton, but the men refused to consider this offer, entirely ignored the agreement with the operators, and issued an ultimatum that unless an increase was given of 15 per cent. to men receiving more than $3.50 per day, and 20 per cent to men receiving $3.50 or less per day, a strike would be called. The operators had little option. They are unable to raise the price of coal because of the restrictions imposed by the Fuel Controller, and to grant the demands of the men would have meant unprofitable operation of the collieries. The men refuse a Conciliation Board. They have so far ignored the instructions of the Fuel Director to return to work, they have violated both their agreement and the provisions of the Industrial Disputes Act, and apparently the authorities, notwithstanding all the special powers given to the Department of Labor and the Fuel Controller recently, are unable to bring the strike to an end.

Poor Timed Strike

A strike of any kind to-day is deplorable, but a strike of coal miners — in direct proportion to its extent—aids the enemy and hinders the war effort of the Allies. Individually, the miners of Pictou County are probably not lacking in patriotism. Their enlistment record stands to prove the contrary. They are not under-paid, and they have already lost far more in wages by idleness than they can make up in many months by any increases in wages they can hope to obtain. There is an economic limit to this matter of wages, and in the case of the Pictou coal companies this limit has been reached. Nothing can force a coal operator to persist in unprofitable operation of his properties. The only way out of the present deadlock is for the Government to take over and operate the collieries, which will mean saddling the Government with a monetary loss, and surely the Government has enough expenditure before it not to require such a proceeding.

A Grave Danger

The writer has on several occasions pointed out in these columns that a further reduction in the coal output of Nova Scotia seemed inevitable, owing to the reduction in the working forces, the entire cessation of immigration, the further operation of the Military Service Act the physical condition of the collieries, and the increasing costs of wages and materials; but no one seriously contemplated a strike of such an uncalled for and flagrant character as that now existing in Pictou County. The only explanation appears to be that the thinking and patriotic miners are all in France, and that the men who remain behind see an opportunity in the present great need of the Empire for coal to press their demands, which are dictated not by any economic pressure arising from low wages, but by a desire to squeeze out of the present national necessity all that the industry will stand. This attitude is, at least, understandable, but the practical repudiation by the men of their agreement admits of no explanation.

Must Have Coal

The production of coal is to-day the first of all military necessities. This statement admits of no qualification, but is the simple sincere expression of a fact. Coal mining to-day is not an industry, properly speaking. It is a branch of the military arm. The coal workers are soldiers, and should be so regarded. No excuses should pass muster for the idleness of a colliery to-day. It is far worse to have collieries idle than it is to have powder factories stopped, to have troopships tied up at the wharf, and to have reinforcements refused to our troops overseas. These things would not be allowed to happen without most strenuous efforts to prevent them occurring, but, unless coal is forthcoming, they must all happen eventually, and while it may be a long time getting there, the reflex of the Pictou County strike will eventually reach France and be represented there by a slowing up of the war effort of our country.

As Veterans See It

At a meeting of the Great War Veterans' Association held in Sydney recently the returned men spoke in no uncertain terms of the unpatriotic action of the Pictou miners, and if workmen will insist on calling such indefensible strikes, they must be prepared for a certain amount of bitter resentment from those who have learned by actual experience what it means to have ammunition and reinforcements delayed when they are supremely needed.

The public sympathises, and all true men sympathise with workmen fighting for their rights, with men who are oppressed and underpaid, but the coal workers in Pictou County cannot say that this is so with them, nor will they be able to defend with any hope of convincing the public a repudiation of their agreement. It is said that to-day every man should work or fight, but the Pictou miners are not working, and are thereby preventing other men from fighting. It is supposed to be a man's privilege to say whether he will work or not, but it is no man's privilege to-day to hinder the fighting effort of our armies. When he does that he is giving comfort to the King's enemies, he is helping the German, and no excuse will absolve either the men who do this, or the Government which permits it to continue.

PIG IRON PRODUCERS ARE NOT SATISFIED WITH DOLLAR BOOST

THE general feeling among the producers of pig iron at U S. points is that the advance of $1.00 per ton allowed by the War Industries Board, is not sufficient. They claim that this small allowance has already been more than absorbed by the increasing charges. The output of pig iron still keeps well in arrears of the demands that are made upon it. The situation at U. S. points is reported to be as follows:

Pittsburgh.—There is a feeling here that the Government now has secured almost perfect control over every situation that can arise in connection with the iron industry. As a result of this, few enquiries are made for material here, and those that are made are referred direct to Washington. Some increases are noted in the production of pig iron now on account of favorable weather and because a better quality of coke is being furnished to the furnaces.

New York.—Considerable tonnage has been lost here because there has not been enough labor to look after the work properly. There is also much speculation here owing to the fact that there seems to be a feeling that the extension of the draft ages may make further serious inroads upon the workers in the mills.

Buffalo.—One of the biggest furnaces in this district is sold up entirely for 1918 and is taking no business at all for next year on the theory that the Government is going to look after the sales.

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		$32 75
Lake Superior, charcoal, Chicago		37 50
Standard low phos., Philadelphia		.....
Bessemer, Pittsburgh		37 25
Basic, Valley furnace		33 40
Government prices.		
	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	100 00	95 00
Spelter	10 75	11 00
Lead	10 50	10 00
Antimony	16 00	18 00
Aluminum	50 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 37

	Black	Galvanized
Standard Buttweld		
	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19
Standard Lapweld		
2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	30 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

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

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	.0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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..	$ 8 00	$ 8 25
Sheets, black, No. 10..	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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...	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck..	2 00
Emery in kegs, American....	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod..	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra..	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

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AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

October 10, 1918. Volume XX. No. 15.

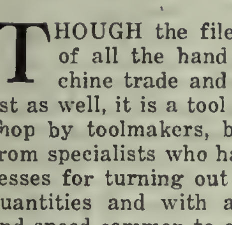
Making of Files Used to Be All-Hand Work

Interesting Features of an Important Piece of Work—Just Now the Securing of Material and the Making of Files is Proceeding Under Cramped Circumstances

By DONALD A. HAMPSON, Assoc. Mem. Am. Soc. M. E.

THOUGH the file is the most used of all the hand tools in the machine trade and is one of the oldest as well, it is a tool never made in the shop by toolmakers, but always bought from specialists who have developed processes for turning out files in enormous quantities and with all the uniformity and speed common to other lines of modern manufacturing. There are about a score of file factories on this side of the Atlantic—not very many—so it is not strange that most machinists have never seen a file made nor have followed the interesting steps in the process. In the early days of the business the work was all done by hand—the file was forged out on the anvil, the teeth were cut with a hand chisel and a hammer, and the file was hardened by heating in the forge fire and dipping into the tank at the side of the forge.

Naturally the results of this early day work could not compare with and could not be expected to compare with the files



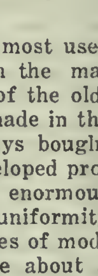


FIG. 1—CUTTING OFF BLANKS. FIG. 3—FILES PUNCHED FROM SHEETS.

which we can purchase so cheaply today. The early file maker taught his sons and kept the secrets of the trade in his family; these little file factories trained the apprentice, who later became the skilled workman in the plants which followed, a greater capital was needed and the demand for files increased. Machinery slowly came into use, and then, along in the seventies and eighties, and right up to this time the file business came in for its share of the attention and research through which the mechanical world has made such great strides.

In passing it is worthy of notice at this time when prohibition has come so much into actual and enforced being, that over-indulgence in liquors was one of the chief factors in the introduction

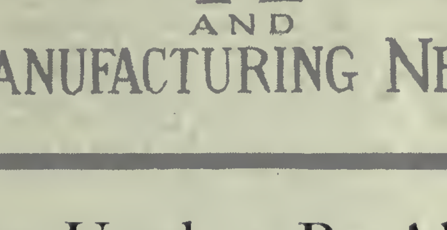


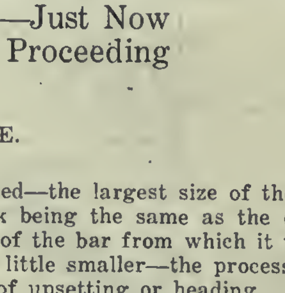
FIG. 2—SHEAR BLADES FOR FILE STOCK

of machinery into the file making business. It has been said that file making was a closely held trade; the skill of these artisans was truly marvellous as we can appreciate when we compare the hand cut and machine cut teeth on so-called Swiss files—not one machinist in a hundred could do more than guess as to which is hand made. These file makers felt a true pride in their work; they thought they could not be superseded by any process, and being a well paid jolly lot, were wont to spend a day or two a week with boon companions in the vicinity of a friendly tavern, much to the exasperation of the worried shop owner who never caught up on his orders. At such junctures as this, the inventor with a new machine or process found a willing audience with the owner, who was only too glad to find a way to get along with a few less men or to substitute less skilled labor for that which was causing him his worries.

The Processes

"File steel" comes in bars of the right shape for all the types of files in common use, but to make the file thinner and narrower at the point, and to give the "belly" which is necessary to straight filing, the blank must be forged to size. The bar stock, which is a high carbon tool steel, is cut up and, and these shorter pieces drawn out and tangs formed—the largest size of the finished blank being the same as the cross section of the bar from which it was made or a little smaller—the process is never one of upsetting or heading.

Success in the file business to-day is gained by exactly the methods which have enabled other lines of metal working to meet competition and show a profit, i.e., attention to details and system. One of the paradoxes is the saving of money by doing an occasional extra operation (to make a subsequent one a quicker operation). To-day the size and shape of every file made is laid out on the drawing board and the standard maintained; there was a time when the plant's die maker established the standardard, and according as to whether he



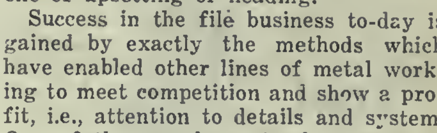


FIG. 4—ROLLING BLANKS. FIG. 6—SURFACE GRINDING.

modeled the new die after an old file or after a new idea of his own, the blanks looked like real tools or like clubs.

Waste, of course, is taboo. The bars of steel are cut off in shears the same as in machine shop practice. But there is a form of shear shown at A, Fig. 1, that is better adapted to file work than the usual type, which is shown at B. The shear at A cuts half way through the bar from each side, something (combined with the sharp jaws) that disturbs the grain of the steel less than the other method; then, too, the ends of the pieces have a double bevel such as would be put on the blank even if it did not come this way. The blanks should be cut off considerably shorter than the file-to-be to allow for the drawing out they get in forging; during the forging the belly and the tang are formed and the blank lengthens correspondingly. A few makers still do not "shape" the files enough—leave them too stubby—and while this makes the forging operation easy, it makes a poorer working file and is a waste of steel. By cutting the blanks short enough and drawing them

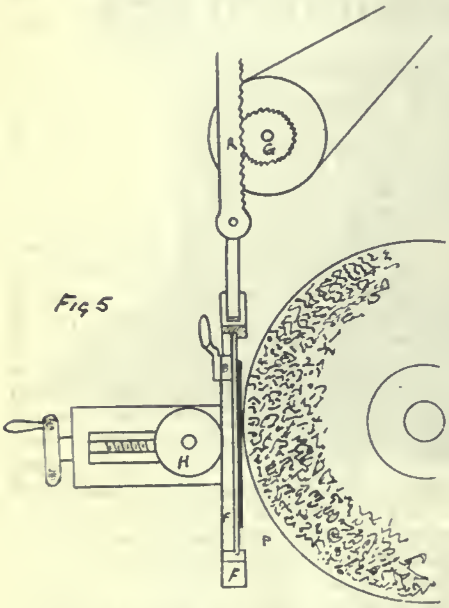


FIG. 5—GRINDING FLAT SIDES.

out more, not only will the file do more and straighter work in the hands of the user, but there will be a saving of steel amounting to from one to four more blanks cut from every bar.

In shearing blanks from the bar, dies are sometimes used for shapes other than rectangular. Round, square, and triangular shapes are cut with special dies with less crushing at the ends than when ordinary shears (as B, Fig. 1) are used for the purpose. Fig. 2 shows the lower members of sets for round and square bars. The upper member for three-cornered files is merely a straight blade, for square and round files, it is a duplicate of the lower one.

Forging

Forging, the succeeding operation, is one full of interest. Almost all the common machines for the purpose are used in forging files. The helve hammer, strap, spring, and drop hammer, all are used for different kinds of files. Drop forging is resorted to on half rounds and very thin files—work where the flash from ordinary die work is objectionable.

As has been said before, the shape of the dies has everything to do with the appearance of the files. File dies conform to regular form for shaping the edges, and in the center is the form for the broad working face of the file. Rounds are formed in a single pair of recesses. Tangs are forged at a separate heat and in separate dies. This gives the forger a free end to hold with his tongs. The furnaces are located close to the hammers so the forgers can sit before the latter and still be able to reach the red hot blanks. Furnace tenders load the files into the furnaces, and one such keeps several forgers supplied, thus allowing the latter to devote all their attention to the work where their skill counts for most. The forgers handle the files very rapidly, changing from side to side of the die, and finishing a file complete at one heat.

Two of the rectangular files—mill and warding—have a uniform thickness throughout their length. In sizes up to 8 inch they are now "forged" almost entirely by stamping on a punch press. Tangs included, they thus come out of the die ready to grind. Fig. 3 shows the general layout as these files are punched, though they are spaced somewhat closer together for economy of steel. The steel comes in sheets of thicknesses for each size of file.

Another most interesting variation of the forging process is "rolling." The machines used bear a resemblance to the two-high rolls of the steel mill. Fig. 4 is a diagram of the elements. The two rolls are geared together and driven so their line of tangency is moving toward the workman. The body of each roll is smaller in diameter than the working portion, or dies, and this opens a space during every revolution through which the file blank may be thrust against the stop S which is adjustable for different lengths. The dies are removable; they are made of carbon steel, though sometimes chilled iron is used for simple forms.

The working face of the dies is not concentric but changes, so that while the dies just grip the blank at the heel tight enough to drive it, they roll the blank thinner toward the point. By shifting the gears the point can be made thinner at will. Usually the dies have several impressions in their face so that as many sizes or shapes can be rolled without changing. The rolls are so driven that one of them has a slight movement in the direction of its axis which is for the purpose of forcing the metal into closer contract and counteracting spreading.

Rolling is particularly fast. So fast that often a furnace is placed on each side of the rolls. Roughly, rolling will produce three to four times as many files as a hammer. Tangs are rolled, usually by boys. A boy can roll as high as 600 doz. tangs a day, while a skilled forger would do but a fraction as many. In fact, the rolling machine was scoffed at until shops could not get production from the skilled forgers who were inclined to be independent as to output. Forging rolls are usually made with a breakdown at one side to assist in reducing the section on some shapes.

Annealing

After forging the blanks are annealed to relieve strains and to make them dead soft for cutting. The blanks are stacked in piles in the furnaces and heated to a full red, they are kept at that heat for from four to eight hours, then the heat is turned off and the furnace sealed, allowing the steel to cool off slowly, which takes (or should take) from thirty to forty hours. The differences in time stated are the natural differences resulting from various types of furnaces, the manner in which they are loaded, the size and shape of the files, and the particular shop processes.

Annealing is an exceedingly important

FIG. 7. OLD METHOD OF GRINDING ROUNDS

operation, the quality of the file being no better than its annealing. Too much heat injures the steel and too little produces a file with hard and soft spots as it is cut, followed by warping in the hardening. The old method of judging the temperature of the furnaces was by noting when the piles of files "got red"; after that point was reached the fire was continued for so many hours and then drawn, after which the files were allowed to cool down. Pyrometers have replaced eye methods in up to date practice, and files are annealed with the same accuracy and uniformity that gears are treated. Formerly the furnaces were heated with egg coal; this is expensive in first cost and for attendance and difficult to regulate to an exact temperature. Many coal furnaces have been rearranged for oil or gas fuel, and the result is a decreased fuel and labor charge, together with much closer regulation. When the gas used is free from sulphur the flame may be turned directly in the heating chamber with no injury to the file blanks, but when sulphur and certain other elements are present the muffle type of furnace is safer to employ —the cost of operation and time of heating being correspondingly greater. The

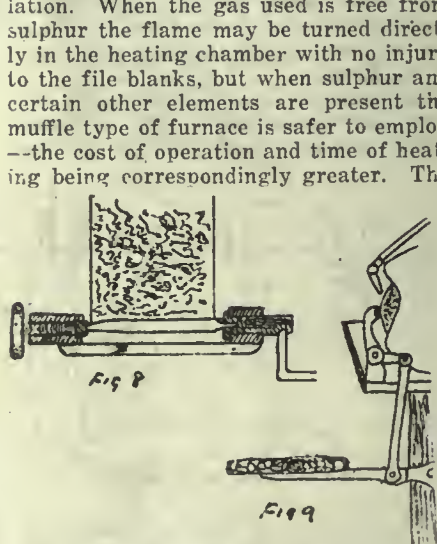


FIG. 8—FORM GRINDING ROUND FILES.
FIG. 9—GRINDING ROUNDS.

gas made from naptha is said to be the best for a direct flame.

The forge furnaces are subject to the same remarks in regards to fuel. The economy of a piped fuel supply over one that has to be trucked is obvious. With the proper kind of gas there will be very little scale left on the hammers and the annealed blanks wil have a minimum of scale to grind off. Economy of space and a clearer atmosphere are additional points in favor of gas and oil.

Grinding

Grinding follows the annealing. Its purpose is to remove the scale and to produce an even, smooth surface for the cutters. It is a well known fact that after a thorough annealing a piece of tool steel cannot be hardened on the untouched surface—in shop parlance, the carbon is burned off the surface. But if a hundredth of an inch is taken off that blackened outside, this new surface hardens at once. The provides one reason for grinding, and another is that in the heating and various handlings the surface may get slightly briused or the file may get a little bent. All this is removed in grinding. If a single black spot is left on then there will be a soft tooth.

Custom and precedence have fixed certain processes in the minds of file workers as standard. Nowhere have these "standards" been harder to eradicate than in the grinding department. To the old time file men grinding means natural grindstones, men dressed in leather to keep from being soaked all the time, men sitting in awkward positions astride the grindstones and working thus in a dim light caused by the windows being continually spattered up. In the file, saw, and cutlery industries such conditions are to-day frequently encountered—we who are familiar with grinding as done in machine shops all over the land where light and comfort and cleanliness are synonymous with the

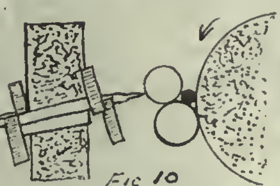


FIG. 10. ROUGH GRINDING ROUNDS

term "grinding" marvel at the resistance of workmen to changes.

Why artificial abrasive wheels—which we will here group as "emery wheels"—are not universally used, is very hard to say. With them suitable work holding fixtures so grinding is not a matter of skill but one of manufacturing uniformity should be provided. The emery wheels should be hooded as a matter of safety—likewise suitable splash plates ought to be a matter of course.

The grindstones still so prevalent are Ohio natural stones of 8 ft. diameter and about 1 ft. face. These cost somewhere around $35, and last two weeks; then it takes two men all day to change to a new one and the "machine" is idle all that time. For rounds and half rounds the grindstone is mounted on an arbor that rests in two heavy pillow blocks and is driven by a wide belt from the line shaft at the back of the room some fifteen or twenty feet away. Flat faces are ground on an interesting machine part of which is shown in Fig. 5. This uses the same grindstone, mounted and driven in the same way.

Referring to Fig. 5, a file is shown in heavy black. Several of these are held in a suitable fixture, or magazine, P, which is in the form of a plate that may be swung back and taken out when the locking bar is tilted back, released by the handle. The grinder runs more than one machine and fills these extra magazines while files are grinding. A yoke piece F is something like a picture frame; it serves as a container for the

FIG. 11. HALF ROUND GRINDING

magazines P, and has machined sides that travel vertically in the side castings of the machine (these not shown). A reciprocating motion is given to F by the rack R and pinion G which are driven from a countershaft and operate in the same manner as a planer shift to get the reverse. The length of the stroke may therefore be adjusted and a constant surface speed of the work maintained.

The rack and the frame are connected by a rod that permits of a limited flexibility so that thick and thin files can be ground. Pressure for grinding is obtained through a roller H set in a slide on each side of the machine, bearing against F, and adjusted by the hand wheel; these screws are connected by a cross shaft so as to act in unison.

The vertical travel of the grinder can be thrown in and out at will. Files can thus be removed or inspected without stopping the stone. In order to prevent the formation of grooves in the stone the latter is given a slow movement and return in the direction of the axis, the mvement being through a cam arranged at one end of the shaft. By this time the reader will have wondered how a (roughly) convex surface is ground by passing the work in a straight line at a tangent to the periphery of the grindstone; the principle employed is to let the work follow the stone and is obtained by using a rubber backing for the files as they rest in the rack or magazine P. The files thus move slightly in their seats, and if the machine is set to grind the point thickness the rubber compresses an amount equal to the difference as the body of the file is being ground.

A more mechanical and modern way is to have the runway for the rollers on the back of the frame F curved, making their surface parallel to that of the file and replacing the adjusting screws by heavy springs which put an even pressure on the grinding at all points. A stop is used to prevent too much grinding in case the operator neglects the machine for any reason. Screws are put back of the springs to regulate the pressure of grinding for different kinds of work and for files of different sizes. Of course this method is more expensive in the first cost for a set of runways, or bearers, must be provided for each shape of file, but the result is a uniform product; there is also a saving in rubber and the cost of renewal.

In file work, the taper of the tang is used to a great extent for holding purposes. The machine just described holds its load by setting one end of the files in a strip with taper slots, the hands grinder jams each file blank in a metal handle, and the cutter has a taper guide or holder on his machine to position the file as it is cut.

From a mechanical standpoint the grinder of Fig. 5 leaves but little to criticise. The production is high, the quality of the work first class, the wheel is well covered and supplied with plenty of water—a trough under the machine catching the surplus and very little spattering about. Water is used in all grinding on files. The grindstones do not glaze the surface of the steel if they have been well cared for, and this is one of the arguments in their favor—the soft, open face they leave on the work. But a stone that has been carelessly exposed to the elements for a length of time will become hard in whole or in part and will do inferior work.

Fig. 6 is a plan view of a surface grinder of the Blanchard or Pratt & Whitney type, arranged to grind flat sides of files. The emery whell is marked "W." On the table of the grinder is mounted a false table P for holding two loads of file blanks. The operator empties and loads at the free end while the load at the other end is being ground. The table P swivels through 180° and locks, which makes an

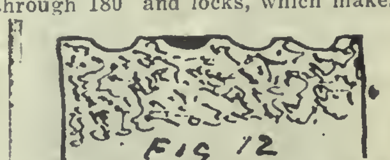


FIG. 12. FORM GRINDING HALF ROUNDS

arrangement that reduces the idle time of the machine to a minimum and keeps the operator fairly busy. Here also are shown the taper notches by which the file is held at the tang—at the other end pins take the side thrust of grinding The production is equal to the other type of grinder; other advantages are the ease and comfort with which the grinder works (and consequently he is better satisfied) and the few minutes only that it takes to change the wheels.

Emery wheels properly selected will do better and faster work than the grindstones. The prejudice against them comes from the hard surface which they leave on a piece of steel—when any old wheel is used at any old speed—as contrasted with the open surface from the grindstones, which come uniformly too soft (often many grades too soft).

Adapting the wheel to the work permits the grinder to produce as nice a surface with the manufactured article and that grit and grade once determined can be reproduced in one of a thousand duplicates. It might be noted in passing that German shops discarded the natural wheels many years ago.

Magnetic chucks have been tried on surface grinders for holding file blanks to be ground, but owing to the first cost of chucks that fit the shape of the blank, very little progress has been made, though the scheme has shown itself to be rapid and practical. Milling of the broad faces of mill and warding files is also done—fixtures of a type that holds several files at once are employed, and where files are large and have much stock to come off the method is preferred to grinding.

Rounds have always been the bugbear of the files business—there is so much hand grinding on them and they require so many more cuts than any other file that there is no money in them, and makers consider them a product to be endured to hold their customers. The time-honored way of grinding rounds is for a man all dressed in leather to sit above one of the grindstones on a "seat," whose real function is to deliver the grinder's weight to the hook shown in Fig. 7, encircling a round file. The grinder thrusts the tang in a metal handle, raises his weight so he can slide the file under the hook, and then sits down to work, turning the file and moving it lengthways to grind over all of the surface. The work is done rapidly, considering the mud and discomfort, but the product can hardly be expected to be uniform. An inspector watching one of these men at work remarked, "That is the least desirable of all the factory jobs I have seen in my career."

Some plants have adopted more modern methods for round grinding. Emery wheels have replaced the grindstones and, whether they have or not, the working position has been changed to the front of the wheel where the grinder can produce in comfort. That a position astride the wheel is not necessary to utilizing the grinder's weight is shown by the most successful arrangement in Fig. 9. Here a fork is connected by levers to the seat, water in plenty is supplied but splash plates keep it on the work. The workman turns the file by hand as before, using a handle for his grip.

As file grinding passed out of the realm of rough work, form grinding came in. Fig. 8 shows an arrangement successfully used to form grind rounds—used with the natural grindstones. The face of the stone is dressed to concave shape by a dresser travelling in a fixture. A swinging bar B has centers in each end to hold round files, with a screw center for tightening and for removing the finished pieces. This bar is brought up until the file touches the wheel, then the handle is turned and the file ground the full length as it is turned. This makes a file of uniform shape and does it in the shortest time. Those familiar with form grinding will wonder why this was never attempted before; the reason is that first custom had to be upset, then the entire standard of the work had to be raised to where the thousands of blanks would come to the grinder so uniform that it was possible to do this operation in commercial time, once the new system was all in operation, the cost dropped and the quality improved.

The rig shown in Fig. 8 is used for several sizes of files without changing the face of the stone. Good rigid fixtures are required and the stone should be tested in practice to determine its nt grade for the work. A similar outfit is used for grinding the backs of half rounds but here the file is turned through an arc of approximately 120° and then turned back, repeating until the surface is clean. Because of the partial surface thus presented a longer handle is necessary than for the continuous rounds. It is understood that such grinding is just upon the straight section of the half round back—the bellied or tapering portion is hand ground.

Fig. 10 shows an interesting grinding operation on round files. Two rollers are mounted on each side of the emery wheel, set staggered to bring their centers closer together without a reduction of diameter. These rollers take the place of a V for supporting and pressing the files as they are ground; the friction is less with rollers than with a plain rest. The axe of the rollers are inclined to that of the wheel though not as much as is shown (shown increased for clearness of illustration). The files are fed in at the right hand side and by the inclination carry themselves past the wheel and out on the left. This device is used for rough grinding and is a great producer; the work produced is equal to the poorer class of hand grinding but it is done in a quarter of the time. The blanks are finished on another machine. The rollers shown are carried in a cradle which is pivoted and pressed against the wheel by heavy springs. Limit stops are provided.

The curvature on the back of half rounds varies on the same file from a radius of ¾ in. to 1½ in., from this it will be seen that any form grinding or travel in a fixed path is impossible for finishing the entire back. That portion of the back which is of fixed radius is ground very successfully on machines such as shown in Fig. 5, the only changes being the disconnecting of the cross movement of the grindstone and the formation of proper radius grooves in the stone, one groove for each file in the rack. Fig. 12 illustrates this in part. Round files are also ground in the same way. After all the stock has been removed on the straight section, the tapering end must be hand finished.

An experimental device has been built to grind the entire back of half rounds on this same machine. The arrangement is shown at Fig. 11. The frame F corresponds to the same part in Fig. 5—it is hooked to the overhead arm to get its vertical movement, just as the other, and locked in place by the bar B. But instead of being held stationary the files are stuck into sockets which are connected with the gears G and their upper ends rest against a plate which is spring supported. In this plate are two pins for each file to keep it confined sideways. The gears are controlled by a rack D which is operated on by a ratchet motion at the bottom of the stroke and so given a movement that turns the file for each stroke, returning when the limit is reached. The device is intended to duplicate the result if the file were traveled lengthways across the face of a wheel and bids fair to working out to a commercial success. The file by spring tension is given a change to let its own shape guide it and remove the same amount from all parts. The pressure of the spring is not as great as used for flat grinding work.

(To be continued)

WOMEN AND MUNITIONS

The immense demand upon the resources of the engineering industry for the production of munitions of war has necessitated many changes in our industrial system in order to ensure the most advantageous employment of labor and material. A great expansion of productive capacity had to be brought about, and while, thanks to the navy the supply of raw materials proved no insuperable difficulty, the provision of the necessary labor to utilize those materials was a question which could not be solved so readily. The number of highly skilled craftsmen in the country was limited, and as such men cannot be improvised, it was essential to utilize their abilities in the most efficient manner, and to drawn upon the general labor resources of the country for all work which could be carried on without the lengthy and specialized training of the all round tradesman.

The wide employment of women in engineering works and the engineering sense and capability that they have developed is undoubtedly one of the outstanding phenomena of the war. Not that there is anything new in the employment of women on engineering and allied work, for it is recorded that half a century ago a firm in Birmingham employed at one time 2,000 women in its works. Generally speaking, however, their female labor was confined to rough and poorly-paid industries, such as the chain, nut and bolt, screw and rivet, and the small metal trades generally, though later women began to take a more intelligent part in the newer industries such as telephone and other instrument making, electrical work, cycles and motors.

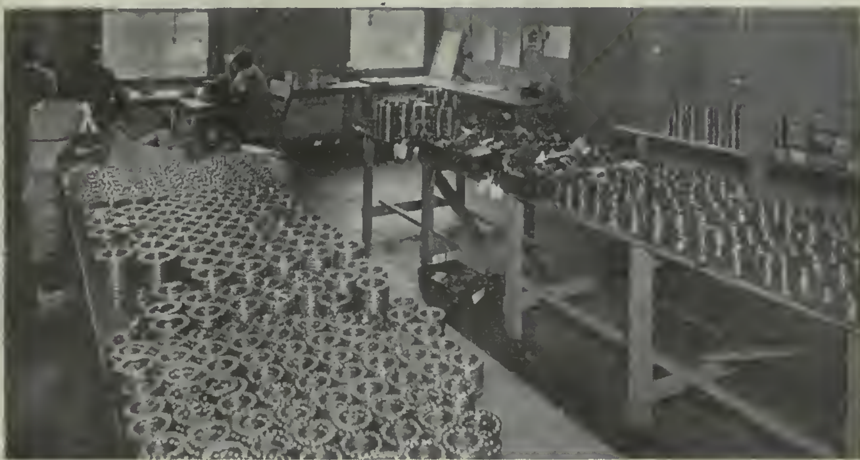
Usually their more advanced work was confined to the operation of automatic and semi-automatic tools such as capstans, presses, drills, screw and gear-cutting machines producing repetition work and requiring little more than manipulative dexterity, though there were a few women in isolated shops doing skilled work on the centre lathe and at the fitting bench; indeed in the works of a prominent member of this institution women were employed on fitting work using micrometers and working to a half-thousandth of an inch, but this was an exceptional case.

War Calls For Great Ball Bearing Production

Demand For This Fitting in Aeroplanes and Motor Trucks Has Been Phenomenal—The Canadian Firm Has Opened up Factories in the States as Well

By T. H. FENNER, Associate Editor

AN industry which was well established and organized before the war was thought of, but has had enormously greater demands thrown on it by the war, is that of making roller bearings. The widespread use of motor traction in all departments of the armies in the field, and behind the armies, and the extensive use of ball bearings in every type of motor, has necessitated the production of thousands, where hundreds sufficed before. Canada is doing her share in supplying this demand, and the plant of the Chapman Double Ball-Bearing Co., Toronto, forms a notable instance. This company has been manufacturing ball-bearings for many years, and their product is well and favorably known in hundreds of industrial plants, so they were well equipped with both the mechanical appliances and the organization to deal with the requirements of the British government in making annular and thrust ball-bearings for automobiles, trucks, and aeroplanes, which work they are chiefly engaged on now, together with the manufacture of shells.



FINAL INSPECTING AND ASSEMBLING ROOM

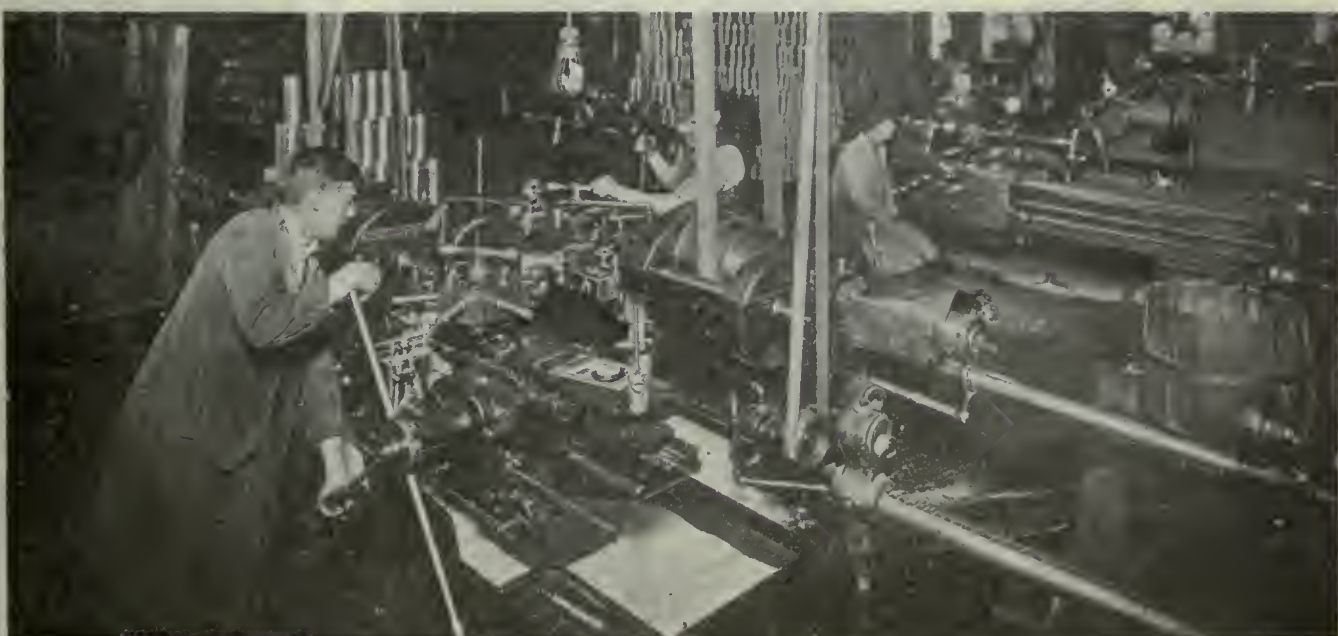
The Annular Ball Bearing

The annular ball bearing consists essentially of three distinct parts, consisting of the outer race, the inner race, and the balls and cage. The outer and inner race are formed from one steel blank, the inner race being cut out of the blanks by a trepanning operation. The first operation on the blank is that of boring the hole on a Colborne vertical boring machine, allowance being made for the subsequent boring and grinding to the finished size. The blank then goes to a Foster hollow spindle turret lathe, of which there are six, shown in the accompanying illustration, and here they are faced on both sides. The next operation is that of trepanning, also performed in the Foster lathe. In this operation a trepanning cut is taken from one side half way through the blank, which is then turned round and cut through from the other face to meet the first cut. The inner and outer races are thus formed in the rough, and are now ready for the initial heat treatment.

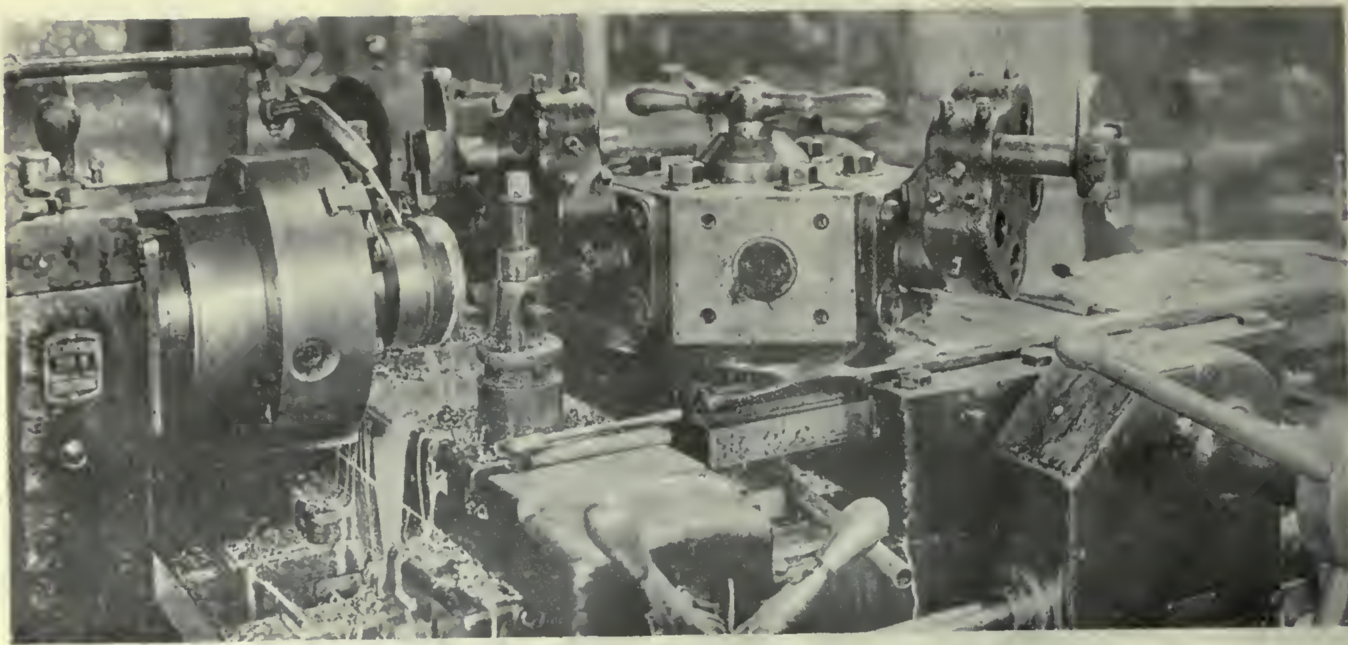
Initial Heat Treatment

The initial heat treatment is carried out in oil burning furnaces, and consists in a gradual heating up to a temperature of about 1375° Fahr. When this temperature is reached they are removed from the furnace and allowed to cool down naturally to the atmospheric temperature, this treatment relieving the metal from the initial stresses set up in forging the blanks. From here the partially formed bearing goes back to the Foster lathes to have the finish turning operations performed on them.

It may be stated here in passing that were it possible to procure steel tubing of the necessary tensile strength and



FOSTER TURRET LATHE TURNING OUTER RACE



FOSTER TURRET LATHES TURNING BALL RACE

chemical composition, a good many operations could be dispensed with. However, it is impossible to procure this tubing at the present day as the demand is far ahead of the supply. A great deal of this tubing used to be obtainable from Germany, but needless to say this avenue is now completely closed.

Finish Turning Operations

The outer race is first placed on a mandrel, and the outside diameter turned up to size ready for grinding. It is then taken off the mandrel and placed in a chuck, and the ball race turned up. The same procedure is followed with the inner race and the next operation is making the slot for entering the balls. The use of this slot makes the entering of the balls into the race considerably easier, and allows for the use of more balls. Incidentally it was the cause of litigation reaching to the Supreme Court of the U. S. The original patent covered an absolutely uninterrupted ball race, and the patentees contended that the inserting slot was a break in the continuity. However, it was shown that the slot was not carried down to the bottom of the race but was left .001 in. higher, thus not interfering with the ball race proper. It can be easily understood that entering the balls without the slot was a difficult operation, as after a certain number of balls were in place the inner and outer race would assume a position slightly eccentric to each other, making the springing in of the last balls a very difficult operation. The use of the slot does away with this difficulty and allows the ball race to be completely filled. After the inserting slot has been made the inner and outer races are stamped with the firm's name and the number of the bearing, and are then hardened. Between each of the preceding operations a preliminary inspection has been made, ensuring that all parts will finish up to size in the grinding operations.

BRYANT CHUCKING GRINDER

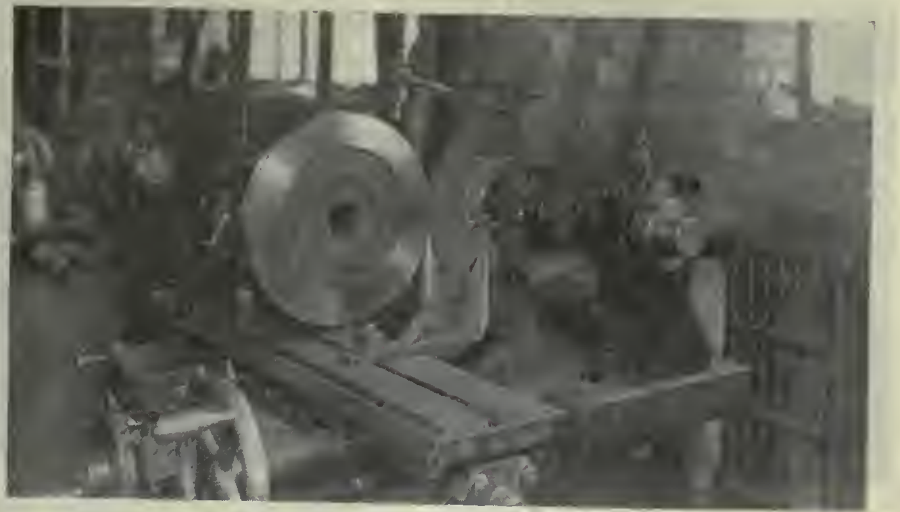
Hardening

The hardening of the races is a part of the manufacturing that has occasioned a great deal of experimentation, and the details of which are carefully guarded by the various manufacturers of ball bearings. The life of the bearing depends on the hardening and the grinding, and it is an open question as to which of these important operations is most influential, some makers favoring the hardening and others the grinding. It is easy to appreciate how much either of these operations can affect the finished product, but where experts differ it is outside of the layman to offer an opinion.

Grinding the Bearings

The grinding is carried out in two stages, rough grinding and finished grinding. In between these two stages a period is allowed for seasoning or what might be called a natural normalizing. This is really a period of rest to correct any fatigue or slight distortion which may have occurred during the rough grinding and is allowed to extend, whenever possible, over several weeks, but when production demands are too great for this, artificial seasoning is resorted to. The grinding operations proper are as follows: First, facing off the rings, which is done in a Blanchard surface grinder, with a magnetic chuck, an illustration of which is here given. The outer rings after facing are placed in a Bryant chucking machine and rough ground in bore, this machcine being shown in the illustration. They are then placed on an arbor in groups according to size and rough ground on outside. They are then chucked on Van Normand and Landis grinders and the race is rough ground.

The inner rings, after facing, are placed on a short steel arbor and the ball race is rough ground on machines made specially for this purpose, from the Chapman Double Ball Bearing Co's own design. Experiments have been made of grinding the race on these rings by placing them on expanding arbors, but the method now used has proven the best. Rough grinding the bore is done in the Bryant chucking grinder and then they are put away for seasoning. A very important part of all these operations is to make sure of perfect cleanliness between each, and great care is taken to ensure that this is done. The finished grinding operations follow the same course as the rough grinding. Grinding the ball slot is a most important phase of the finished grinding.



CHAPMAN BALL BEARING CO.'S GRINDERS

Inspection

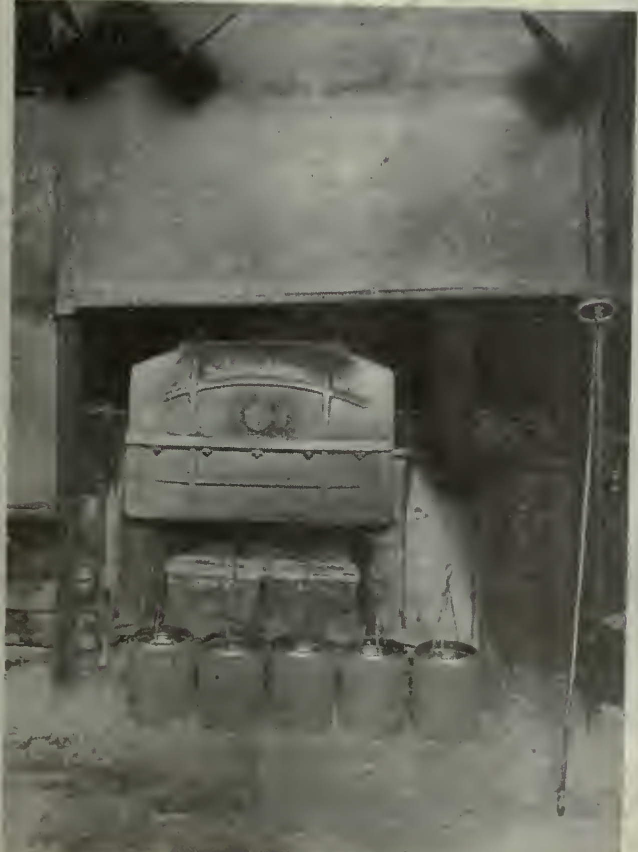
The necessity of a rigid inspection can be readily understood when it is explained that the greatest toleration allowed in any part is .0004 of an inch, and in the case of the race diameters no toleration at all is allowed. Much care and experimenting has been expended in perfecting this department, and large sums have been spent in procuring absolutely reliable measuring instruments. Among these the Prestwich fluid measuring gauges are prominent, and a complete set of standard Johannson blocks are used for checking the working limit gauges. By the use of these up-to-date methods absolute uniformity and interchangeability are procured. To ensure that no damage or rusting can take place during shipment each set of bearings is wrapped in oiled paper and enclosed in a metal case.

The Thrust Bearings

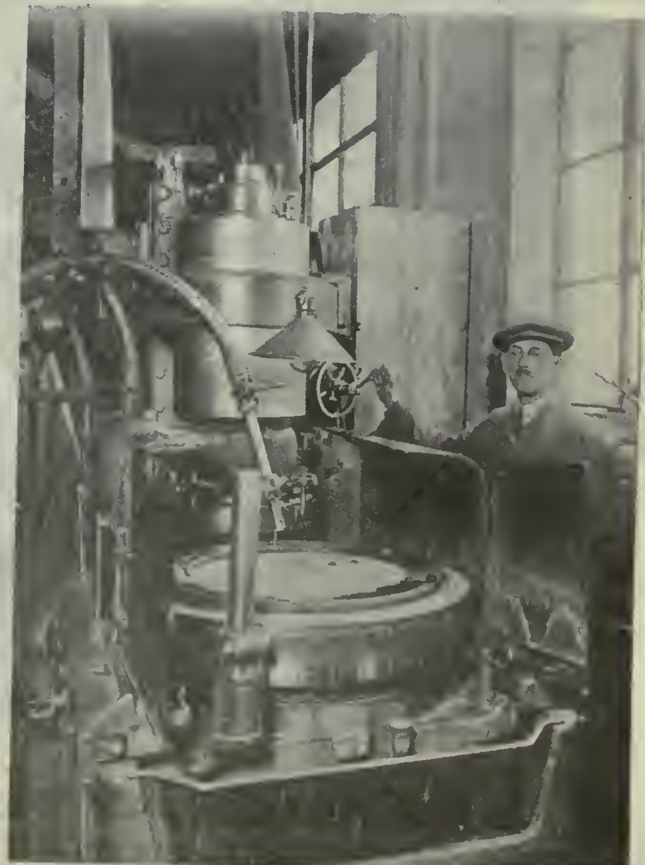
The thrust bearings are made from blanks punched out of strip steel, these blanks being then indented for the ball race. They are then bored and placed on mandrils for turning. They are afterwards hardened, and the subsequent grinding operations consist of grinding the faces, grinding the bore, grinding outside, and then the ball race, which are performed in the machines already described. The ball cage consists of a phosphor bronzs disc, and the holes for the balls are drilled alternately from each face. This method ensures that the weight of the thrust will always come on the balls and not on the cage.

The Organization

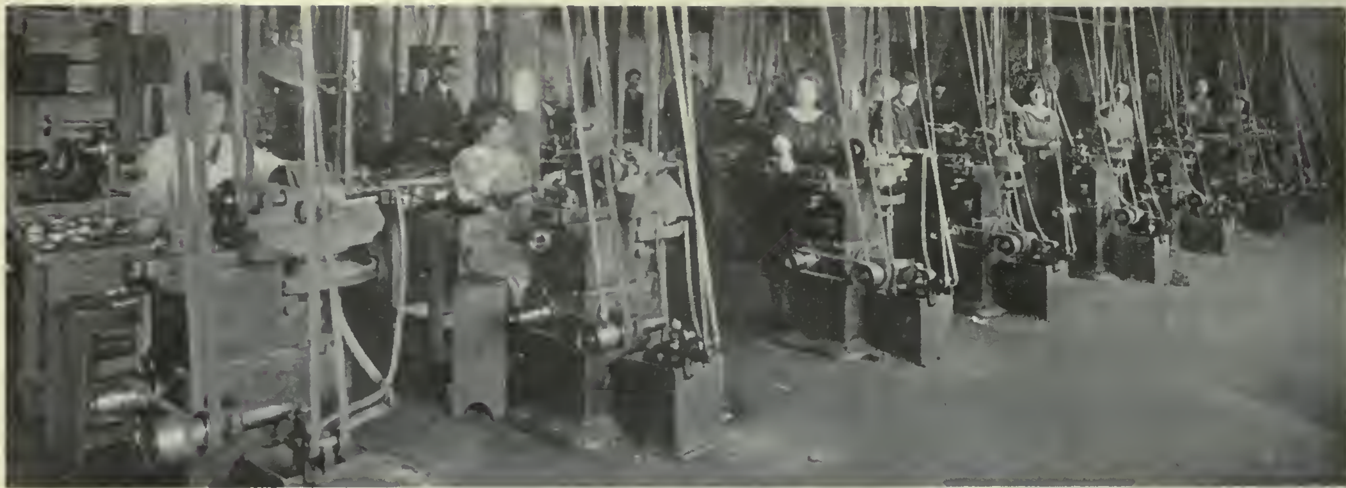
The making of these bearings is a class of work that calls for intelligent and skilled help. This has naturally called for a considerable amount of thought and selection in building up an organization, and has not been all smooth sailing in these days of shortage of labor. Female labor has been employed with considerable success, especially in the inspection departments. The mechanical end of the



OIL FURNACE FOR INITIAL HEAT TREATMENT



BLANCHARD SURFACE GRINDER WITH MAGNETIC CHUCK



VAN NORMAN GRINDERS

business is under the supervision of Mr. W. J. McCallum who has been with the firm for eleven years, for some time as head designer. Mr. McCallum is one of the inventors of the Chapman elevating transfer truck, which is very extensively used in munition and industrial plants. It is chiefly to his courtesy the procuring of the material for this article is due.

STANDARDIZATION IN GAUGE MANUFACTURE

The attainment of a high manufacturing efficiency is very difficult when the energies and interests of a firm are spread over the production of different kinds of products, unless the output of each product is sufficient to justify a separate department, machinery and staff for its manufacture. It cannot be turned out as quickly, cheaply, or with so great a percentage of female labor as it would be under conditions of proper repetition manufacturing, and in the national interest, therefore, firms should be confined as far as possible to the manufacture of the minimum number of different articles. This applies particularly to the case of gauges, cutters, small tools, etc., which in the aggregate absorb a vast and needless amount of highly skilled labor when manufactured in small quantities by firms for their own use. In the interests of the conservation of skilled labor it would be well if all standard tools and gauges required for munition work were manufactured as repetition products in factories set apart for the purpose. In a word, the production of gauges and small tools of all description should be placed on the same basis as that of shells, fuses, or other direct munitions the actual figures of the attainments in each respect of the best firms. But in order to determine the highest practicable standard for any given product more information is required. It is necessary to analyze methods of manufacture down to the smallest details, and to consider every operation in turn both from the point of view of the labor hours involved and of the class of labor necessary to perform it. Such an analysis is no doubt made now in greater or less detail by every firm when planning methods of manufacture, but the author holds strongly that for all munition products the Government should supply such information to contractors. It would avoid all controversy about the possibility of attaining either the efficiency standard or the dilution standard required by the Government, because the possibility could be proved by actual performance. Compulsory adoption of the standardized methods of manufacture is not advocated where firms can produce equally good results by any other methods. But the standard established would assist them in planning work and complying with the Government's requirements as to the maxima of time and labor permissible for a given output. The first objection which will arise in the minds of critics is that all firms are not equally well equipped for production, and that it would therefore be unfair to insist upon the standards of time and labor being universally adhered to. The proposal, however, would have the effect of preventing firms obtaining contracts they are unable to carry out efficiently, and this would obviate the waste of material and labor which now exists. Furthermore, it would justify the application of a firm for such machine tools as would enable it to carry out its contract in the most efficient manner, and would, therefore, rapidly bring about the proper equipment of manufacturing firms for their special products. It would also have a good effect in the standardizing of the best machine tools with a corresponding increase in the number available of the best types.

CONCRETE BASE CAST AROUND BASE OF GRINDING TOOL TO GET RIGIDITY

German Submarine; Its Detection and Destruction

Construction, Operation, Equipment, Methods of Detection, Means of Destruction—Various Proposals Considered

THE bulk of the war's inventions have originated with those who have had a grounding in the sciences or who have been well versed in machine shop practice or in other engineering pursuits. Many impracticable and even ludicrous ideas have been put forward by those who, having the best intentions in the world, were not sufficiently acquainted with the subject to plan intelligently.

In releasing information as to what has been done towards the elimination of the submarine, the Naval Consulting Board of the United States are performing a service which must necessarily awaken interest in those who have the skill to suggest improvements along the lines suggested.

No proposal which involves premises not based on the laws of nature as commonly understood is entitled to be recommended for experiment and development unless the inventor can show that there is a possibility of such laws being erroneous. Many proposals which depend for their operation upon effects which are contrary to natural laws as known have been submitted. Below is given an outline of some of the most popular misconceptions.

Electro-Magnets

Although the laws governing the use of electro-magnets are generally known and applied in a practical manner in a multitude of devices in common use, even the man of wise experience will be astonished at the limited range of their effect. For instance, the magnets used in our manufacturing plants, for lifting heavy masses of iron or steel are designed to exercise maximum magnetic effect, and for operation require a very considerable amount of electrical energy; yet a magnet which can lift twenty tons when placed in contact with an iron plate of that weight will not lift two pounds of iron or steel if separated from it a distance of two feet. Therefore proposed devices which depend on the attractive power of magnets for their operation in deflecting or arresting torpedoes, mines or submarines, must be governed by the simple laws of magnetism. A torpedo weighing approximately 2,500 pounds and traveling at a speed of from 25 to 45 miles an hour, will not be deflected to any considerable degree by any known application of magnetism, and it is not believed that an enemy torpedo, mine or submarine will ever be found in a position to be interfered with effectively by any electro-magnetic means, however powerful.

Detection by Magnetic Needle

Tests made on an actual submarine have shown that the magnetic effects due to this mass of iron, are quite limited in range. For instance at 150 feet distance the magnetic effect due to a submarine is only about 1 per cent. as much as the earth's magnetic effect. The submarine is equipped with a gyroscopic compass that cannot be affected by any magnetic influence from the outside.

Mine Attached by Magnets

A magnet deriving its power from any battery that could be contained within a bomb would not be powerful enough to hold the bomb in contact with a boat running through the water; therefore the scheme is impracticable. The main point would be to locate the submarine. When the submarine is once located very simple methods of disposing of it are at hand.

Electrical Effects

There is a general misconception regarding the electrification of water and the atmosphere. There is no known method of charging the sea with electricity; of shooting a bomb of electricity, or of charging the atmosphere with electrocuting currents. Suggestions along these lines should show that the writer has made research in the laws governing the application of electrical energy, and should contain sufficient proof of their feasibilty to insure serious consideration.

On the other hand applications of the transmission of electrical energy by means of alternating or pulsating currents—as used in wireless systems, for example—belong to a different class of electrical development. Inventive genius is rapidly improving apparatus of this type for the sending and receiving of signals and messages, and the possibility of valuable results in this field is unlimited.

The Submarine and its Operation

The first recorded experiment in submarine operation was made by a Hollander, Dr. Cornelius Van Drebbel, who in 1624 constructed a one-man submarine operated by feathering oars, which made a successful underwater trip from Westminster to Greenwich in the Thames.

Dr. David Bushnell, an American inventor and graduate of Yale in the class of 1755, nearly sank the "Eagle" in New York Harbor during the Revolutionary War by the use of his little one-man-powered submarine, the "American Turtle."

In England, the American inventor, Robert Fulton, in the presence of William Pitt, then Chancellor, and a large number of spectators, blew up a brig by exploding a mine which he had placed under her bottom by the use of his submarine boat. Both of these inventors were discouraged and were refused the necessary assistance to enable them to develop further their ideas regarding submarines, although they had undoubtedly shown that there were great possibilities in the underwater type of vessel

Modern Types

Modern submarines are divided into two general classes: the coast defense type of from 300 to 700 tons surface displacement, and the cruising type of from 800 to 2,500 tons displacement, having a radius of action of from 3,000 to 8,000 miles and capable of operating along the Atlantic coast of the United States from European bases.

Germany appears to be devoting her energy at present to the construction of a small group of a still larger type, reported to have a displacement of 2,800 tons, which also possess superior gun equipment for surface operations, greater speed when cruising on the surface, very much more habitable quarters for the crew, and storage capacity for a larger number of torpedoes and other supplies.

"One-Man" Type

Many hundreds of proposals have been received advocating one-man submarines and submarines of small size, to be manufactured in great numbers for the purpose of attacking and destroying the larger types of enemy submarines. This subject has been given exhaustive consideration and it has been conclusively proved that no small submarine can be provided with the necessary power, speed, equipment and living quarters for the crew to enable it to operate successfully in the submarine zone. Even the smallest of modern submarines requires a number of devices for its successful operation; an internal combustion engine, an electric motor—which also can be used as a generator to charge the storage batteries, water ballast and trimming tanks, pumps, air compressors, air storage tanks, torpedo tubes, storage space for torpedoes, quarters for crew, and other machinery and auxiliaries.

Hull Construction

Generally the German U-boat—which is the designation for the enemy ocean-going submarines—it made with a double hull. The bottom space between the inner and outer hulls is used for water ballast; the top space is used for carrying oil fuel. Water ballast displaces the fuel oil as it is consumed by the internal combustion engine.

The frequent statements that oil has been seen on the sea after a U-boat had been attacked may have merely indicated that the submarine's outer hull had been punctured. However, there is some oil slick on the surface when the exhaust mufflers are flooded.

According to recent statements, the conning tower, in the latest type of German submarine, is protected by a thin belt of armor plate, and the vital parts of the hull, which are exposed when operating on the surface, are also made heavier than the rest of the hull, to protect them at least from the smaller calibre guns.

Even if the periscope and conning tower are shot away the submarine may still be able to keep afloat and operate.

Source of Power

The internal combustion oil engine of the Diesel or semi-Diesel type is almost universally employed for surface operation in modern submarines, although much experimenting has been done with steam-driven craft, and many engineers believe that, for extremely high power, steam may yet be used effectively if some of the inherent disadvantages—excessive heat, etc.—can be overcome. The limit of practical size has almost been reached in the internal combustion engines used in the latest type of submarine, and if more power is needed the engines themselves will have to be improved, or, perhaps steam plants will be resorted to.

Owing to the fact that internal combustion engines require a great deal of air for their operation, which is not available when a boat is submerged, submarines must be equipped with an electric motor run by storage batteries for underwater propulsion. It is, therefore, necessary after the storage batteries are discharged by use, for the boat to come to the surface while its electric generating apparatus, driven by the internal combustion engine, recharges the batteries.

Speed

The speed of a submarine, like that of other vessels, depends upon the power of its engines or motors in overcoming the resistance of the hull to being driven through the water. For submerged operations the electric motor operates the propeller, the engine being uncoupled and the current for the motor supplied by the storage batteries. This electrical equipment, if it be of high power, occupies much space and is extremely heavy, especially if an extended submerged range of action at high speed is desired. Therefore, the space for such equipment on the underwater craft has to be provided by increasing the size of the craft. If high surface speed is also required, larger and heavier engines must be installed, which necessitate an additional increase in the size and displacement of the vessel Maximum surface and submerged speeds cannot both be had in one type of submarine, and therefore a compromise which gives the most efficient general results has to be effected. The main engines in a modern submarine constitute approximately 8 per cent. and the storage batteries 16 per cent. of the total weight of the boat. If greater surface speed is required the percentage of weight allotted to the engines is increased, or, if greater submerged speed the weight of batteries is increased and smaller engines installed. In general, submarines, to be capable of the highest possible speed both for surface and submerged operations, must necessarily be of the largest type, and many predictions of giant submarines are made.

German cruising submarines have a maximum speed of about 17 knots on the surface and 10 knots submerged.

Details of submarine construction are of less immediate importance than ways and means to protect surface vessels from submarine attack, but details of construction and of the many life-saving devices, such as detachable chambers or conning towers, and other mechanisms which have been proposed, experimented with and discarded, may be found in the references mentioned on a subsequent page.

Listening Devices

The submarine when submerged so that its periscope does not project above the water is blind, but not deaf, for it is provided with sound detectors or microphones that will indicate the approach and direction of a ship, if its own machinery is at rest or moving slowly, with noise so slight as not to interfere with the listening.

The propagation of sound through water is more rapid and efficient than through air, because water does not have so great a cushioning effect upon sound waves. While we speak of sound waves, and can measure their amplitude in some cases, there is no bodily displacement of the medium through which they travel. In general, the harder, denser and more incompressible the medium, the more efficient the transmission of the sound waves.

The underwater listening devices which are so frequently availed of in submarines and patrol boats and destroyers used to attack them consist primarily of a large diaphragm or its equivalent in some other physical form. The diaphragm is submerged and the pressure of the water upon it tends to cause it to deflect inwardly to a slight extent. When the sound wave strikes the diaphragm the deflection is increased and, when the wave has expended itself it is followed by a reduction of pressure which allows the diaphragm to recover until the succeeding wave strikes it.

The human ear can detect sounds having periods of vibration as low as 16 per second and as high as 30,000 or 40,000 in extreme cases, so that there is a very wide range of pitch over which listening devices might be used.

The vibrations emitted from a submarine are usually of low frequency and therefore the listening devices which are particularly designed for submarine detection have to specially adapted to low frequency, at the expense in many cases of their capacity for receiving the high frequency vibrations; whereas with submarine signaling devices designed to communicate from one vessel to another a frequency of several hundred vibrations per second is found to give better results.

In one typical form of listening device the diaphragm is provided with a telephone transmitter. The vibrations of the diaphragm vary the electrical resistance in the transmitter, which are either listened to by a telephone receiver directly or amplified by means of relays, such, for instance as the audion and other similar apparatus, which enables sounds to be heard which otherwise would be inaudible.

Ways and means to tune out extraneous noises, such as the falling of rain on the surface of the water, the noise of the pumps and other machinery on the boat carrying the listening device, and arrangements to determine the direction of the source of sound have been given a great deal of study and been developed to a considerable degree of effectiveness. Sound waves tend to emanate from the source radially, which is availed of in the direction-indicating devices. However, the details of these devices are more or less confidential, and only the great principles can be made available to the public.

Periscopes

The superior gunfire to be expected from a merchantman which has been properly equipped makes it prudent for the hostile submarine commander to obtain his observations for accurate aiming of the torpedo through a periscope.

A submarine is usually equipped with two or three periscopes, extending about twelve feet above the conning tower, the more recent periscopes being of the "housing" type, which permits them to be quickly raised and then drawn down after the observation, thus allowing the undersea boat to operate unseen much nearer the suface and not lose time in changing its depth of submergence.

It is rumored that the latest German U-boat has a short periscope "fair-water," which encloses the stuffing-box through which the periscope slides up and down. The periscope fair-water usually extends 4 or 5 feet above the top of the conning tower. The short periscope is used when the boat is moving at considerable speed through the water. An additional periscope, which can be extended to a height of from 14 to 16 feet above the periscope fair-water, is also provided. It is used only when the boat is stationary or nearly so. This taller periscope is used to reduce the chances of exposing the conning tower and hull of the submarine while patrolling in a rough sea, with the hull submerged. It is very small in diameter at the top and is commonly called the "finger" periscope. Owing to the vibration prevailing at any speed above four knots it cannot be used when a submarine is moving rapidly. A third periscope, smaller in diameter, is usually provided as a spare in case of accident to the two periscopes described above.

A periscope is usually designed to have about a 45° angle of horizontal field of vision, and the vertical field may be less. It is rotated by the observer in order to scan the whole horizon.

When a submarine is cruising on the surface the top of the periscope may ex- to a height of 23 or 24 feet above the water, thus giving a range of vision of about six miles to the horizon, if the day is bright; while an observer standing upon the conning tower can see the horizon at a range of only about four and one-half miles; however, the observer can usually see much more distinctly by his direct vision than through the periscope. The upper parts of ships can, of course often be seen beyond the horizon.

Greatly increased optical efficiency in the periscope is not a theoretical possibility, although various sizes and designs have been experimented with. Any increase of submerged diameter, or length of periscope impedes the submerged speed of the submarine. The older type gave a great deal of trouble from defective mechanical construction, but the more modern devices are hermetically sealed by the manufacturer and are reasonably free from condensation of moisture on the lenses and from vibration.

Experiments have been performed on the subject of decreasing the visibility of periscopes. It is very difficult to see a periscope, and the artistic use of paint, simulating foam and green water is one of the best means of making a periscope invisible. A periscope so painted, projecting a few feet above the water from a motionless submarine, can be seen at a very short range only, and if it is thrust up in quick observation and then withdrawn the presence of the submarine is usually not disclosed.

The use of mirrors has been suggested and experimented with, but the conclusion has been reached that their use is not practicable. Any rolling of the submarine will change the angle of incidence and reflection, and serve to reveal the position of the submarine.

Periscopes having their upper portions made of glass tubing to reduce the visibility have also been proposed.

It is, however, the wake of the periscope on a moving submarine rather than the periscope itself that attracts the attention of an observer.

Net-Cutting Devices, Etc.

Numerous devices and attachments have been provided to enable submarines to cut nets, put out divers, and to send a marking buoy to the surface in case of accident, and have proved more or less ineffective.

In manoeuvering it requires at least 60 feet—preferably 100 feet—depth of water to remain concealed and safe from gunfire, ramming, or collision with surface craft. Submarines are frequently tested for safe operation at depths of as much as 200 feet, at which depth few effective obstructions, trawls, or nets can be used against them.

A modern submarine may, if it is in good order and the hull not punctured, remain resting safely on the bottom for a day or more without inconvenience to the crew. Under favorable conditions, when the waters are less than 200 feet in depth, a submarine might lie at rest on the bottom and detect the approach of a vessel several miles away. In case the water is more than 200 feet in depth a submarine must usually be kept in motion to obtain steerage-way in order to hold its proper depth of submergence. This speed need not exceed one knot.

In its method of attack the submarine has many advantages over its adversary. The ship to be attacked presents a definite target of comparatively large size, and is easily seen by the submarine commander at a range where the submarine's periscope is usually quite invisible to those on the surface vessel. Even though the submarine be cruising on the surface it is not easily seen, because it has a very low freeboard.

As the submarine approaches an enemy's surface vessel it submerges, the periscope being the only evidence of its presence. Periscopic sighting of the target is necessary, as it has been found impossible to see through an underwater window far enough for practical observation. In the event of accident to the periscope a submarine must come to the surface for observation or else manoeuver blindly. If the sea be rough or the weather misty or foggy, the periscope may not be seen until its prey is destroyed by a torpedo, and in some cases not even then. The submarine commander thus has every opportunity to verify his adversary's identity, speed and course, also to decide upon the most vulnerable point of attack, and to place his boat in the best position to discharge an effective shot. Torpedoes may be discharged with equal effectiveness whether the submarine is on the surface or is submerged, but at the most effective range, say one half mile or less, the superior gunfire and greater accuracy of the guns of armed merchantmen and war vessels (because of their higher and steadier gun platforms) make the defeat of the submarine, operating on the surface, probable—in fact almost certain—if the torpedo attack is unsuccessful. A single effective shell might disable or sink the submarine because of its relatively small positive buoyancy, while the surface vessel might have many shells strike it and still remain in a seaworthy condition.

SAYS THAT THE BONUS PLAN OF WAGES HAS BEEN FAILURE

As an incentive in speeding-up production on war work, and at the same time with the idea of maintaining high standards of workmanship, many firms have adopted a bonus system in remunerating their mechanics. It is further felt that the plan would reduce to a minimum any feeling of restlessness among workmen and hence keep the organization intact. How is the plan working out? Most manufacturers have some interesting experiences to relate.

"I will say that the bonus system is a failure," said the head of one large eastern concern. "There is not a firm in Canada to-day that is paying better wages, or trying more seriously to be fair to their mechanics. Yet their attitude in these later days of the war suggests that if we can pay them so much under the bonus system, we can afford to pay it to them as regular wages.

"At first, the plan worked splendidly. But at that time, the men had not forgotten conditions under which they had worked prior to the war. Comparison was a simple matter—even to the simple minded. But now, they seem to have forgotten that a bonus is something they actually earn over and above their regular wages. They may earn their wages and they may not, but the bonus they must work for.

"In spite of this opportunity to make good money, there is still a lot of restlessness, still the petty distinctions made as between union and non-union men—even though wages be higher and conditions better than that required by the union. We have found in some cases that better work has been done by unskilled workmen than by the skilled mechanic who is getting high wages. We tested it out recently. A skilled mechanic was set to work on a certain job. At the end of the day he had produced six articles at a cost of $7. Then the work was placed in the hands of an unskilled workman and he actually turned out six an hour. I pointed out to the men that if we could afford to pay $7 for six articles we could afford to pay that unskilled workman at the rate of $50 a day. It is this indifference, this apparent unwillingness to speed up that is the trying proposition to the manufacturer.

"There is a great scarcity of skilled mechanics at the present time and it is deplorable that there should be a dog-in-the-manger, now-we-have-you-where-we-want-you feeling among any of the available men. Even where it exists in a very minute degree it is bound to retard production. Heaven knows that the manufacturer is not trying to take advantage of workmen. There are mechanics in our shop to-day who are actually receiving more than the superintendent. One of our bosses remarked recently upon the somewhat amusing fact that he was paid $150 a month for watching a number of men, some of whom were getting over $200.

"We have pointed out to men that the country is paying well for their services and that they should give the best that is in them. In many cases that fact does not stick. There are men and always will be men who recognize no responsibility, no allegiance toward their work or their employer and who feel that it is their privilege to make a bee line from one job to another at any time and without notice. It is most unsettling. I will say it is unpatriotic.

"It is of course, one of those regrettable conditions of war time. 'C'est la guerre,' the French say, but it would be delightful if all men recognized this duty in wartime. There is a time coming of course, which may impose something like normal conditions—but let all men recognize that the country is in this thing for victory and that every member of an organization should give the best that is in him."

Dividing Essential from Non-Essential Lines

How United States Authorities Have Listed the Industries so That War Contracts Shall Have the Preference—Four Classes and Various Divisions of Each Section

WM. BARUCH, chairman of the War Industries Board, has issued the new preference list of industries and plants, compiled by the Priorities Division of the board.

E. B. Parker, chairman of the Priorities Division, states that the determination of the relative importance of all industries and plants for both production and delivery by a single agency, the War Industries Board, renders it possible to maintain a well-balanced programme with respect to the several factors entering into production, which includes among other things plant facilities, fuel supply or electrical energy, labor and transportation, without all of which production is impossible.

Judge Parker says: "The administration of priorities is calculated to bring order out of chaos and to develop an evenly balanced industrial programme to meet the requirements of the military programme, and at the same time supply to essential requirements (as distinguished from the mere wants or desires) of the civilian population. Now that it is understood that priority and preference cannot be purchased the tendency is for prices to assume more nearly the normal level. It is now the public interest rather than the dollars of the purchaser that determines precedence in production and delivery."

An explanatory statement signed by Mr. Baruch and Judge Parker says in part:

For the guidance of all governmental agencies and all others interested (1) in the supply of labor, and (3) in the supply of transportation service by rail, water, pipe lines or otherwise, in so far as such service contributes to production of finished products, the accompanying designated Preference List No. 2 has been adopted by the Priorities Board, superseding Preference List No. 1 adopted April 6, 1918, and all amendments and supplements thereto.

Where it is imperative not only to maintain but to stimulate and increase production to satisfy abnormal demands created by war requirements, a high rating is necessary, even though the intrinsic importance of the product may be less than that of other products placed in a lower classification because of the fact that the supply of such other products equals the demand without the stimulus of its priority. Were it is necessary to speed the production of a particular product required at a particular time to carry into effect an important programme, a high priority is given although changing conditions may thereafter suggest and demand a reclassification. Certain plants produce commodities of great relative importance, but at the same time produce other commodities of less relative importance, and under such circumstances consideration and weight is given to the ratio of production between the more important and less important commodities. Instances occasionally arise where individual plants are given preference so long as they are rendering, and so long as it is in the public interest that they should render, a particular service, even though, taking the country as a whole, the supply of their product is ample to meet all demands.

The industries and plants grouped under Class 1 are only such as are of exceptional importance in connection with the prosecution of the war. Their requirements must be fully satisfied in preference to those of the three remaining classes.

Requirements of industries and plants grouped under Class 2, Class 3 and Class 4 shall have precedence over those not appearing on the preference list. As between these three classes, however, there shall be no complete or absolute preference. It is not intended that the requirements of Class 2 shall be fully satisfied before supplying any of the requirements of Class 3, or that those of Class 3 shall be fully satisfied before supplying any of those of Class 4. The classification does, however, indicate that the industries and plants grouped in Class 2 are relatively more important than those in Class 3, and that those in Class 3 are relatively more important than those in Class 4. It will often happen that after satisfying the requirements of Class 1 the remaining available supply will be less than the aggregate requirements of the other three classes, in which event such supply will be rationed to the industries and plants embraced within those classes. The Priorities Board will from time to time, after conference, and in cooperation with each of the several governmental agencies charged with the distribution thereof, determine particular principles, values and methods of application which may be followed in allocating fuel, power, transportation and labor respectively, to the end that proper reorganization and weight may as far as practicable in each case be given to the relative importance of Class 2, Class 3, and Class 4.

Each plant listed as such shall not later than the fifteenth of each month file with the secretary of the Priorities Board, Washington, D. C., a report on P. L. Form No 3 covering its activities during the preceding month. Any plant failing to file such report will be dropped from the preference list.

Priorities in the supply and distribution of raw materials, semi-finished products and finished products shall be governed by Circular No. 4, issued by the Priorities Division of the War Industries Board under date of July 1, 1918, and all amendments and supplements thereto or substitutes therefor.

This preference list shall be amended or revised from time to time by action of the Priorities Board to meet changing conditions. The Priorities Commissioner shall, under the direction of and with the approval of the Priorities Board certify additional classes of industries and also certify additional plants whose operations as a war measure entitle them to preference treatment.

List of Industries

Agricultural Implements.—See "Farm Implements."

Aircraft.—Plants engaged principally in manufacturing aircraft or aircraft supplies and equipment—1.

Ammunition.—Plants engaged principally in manufacturing same for the United States government and the Allies. —1.

Army and Navy.—Arsenals and navy yards.—1.

Army and Navy.—Cantonments and camps.—1.

Arms (small).—Plants engaged principally in manufacturing same for the United States government and the Allies. —1.

Bags.—Hemp, jute and cotton. plants engaged principally in manufacturing same.—4.

Blast furnaces.—Producing pig iron. —1.

Boots and Shoes.—Plants engaged exclusively in manufacturing same.—4.

Brass and Copper.—Plants engaged principally in rolling and drawing copper brass and other copper alloys in the form of sheets, rods, wire and tubes.—2.

Buildings.—See "Public Institutions and Buildings."

Chain.—Plants engaged principally in manufacturing iron and steel chain.—3.

Chemicals.—Plants engaged principally in manufacturing chemicals for the production of military and naval explosives, ammunition and aircraft and chemical warfare.—1.

Chemicals.—Plants, not otherwise classified and listed, engaged principally in manufacturing chemicals.—4.

Coke.—Plants engaged principally in producing metallurgical coke and by-products, including toluol.—1.

Coke.—Plants, not otherwise classified and listed, producing same.—2.

Copper and Brass.—See "Brass and Copper."

Cotton.—Plants engaged in the compression of cotton.—4.

Cotton Textiles.—See "Textiles."

Cranes.—Plants engaged principally in manufacturing locomotive or traveling cranes.—2.

Domestic Consumers.—Fuel and electric energy for residential consumption, including homes, apartment houses, residential flats, restaurants and hotels.—1.

Domestic Consumers.—Fuel and electric energy not otherwise specifically listed.—3.

Drugs.—Medicines and medical and surgical supplies. Plants engaged principally in manufacturing same.—4.

Electrical Equipment.—Plants engaged principally in manufacturing same.—3.

Explosives.—Plants engaged principally in manufacturing same.—3.

Explosives.—Plants engaged principally in manufacturing same for military and naval purposes for the United States government and the Allies.—1.

Explosives.—Plants not otherwise classified or listed, engaged principally in manufacturing same.—3.

Farm Implements.—Plants engaged principally in manufacturing agricultural implements and farm operating equipment.—4.

Feed.—Plants engaged principally in preparing or manufacturing feed or livestock and poultry.—

Ferro-Alloys.—Plants engaged principally in producing ferro-chrome, ferromanganese, ferro-molybdenum, ferrosilicon, ferro-tungsten, ferro-uranium, ferro-vanadium and ferro-zirconium.—2.

Fertilizers.—Plants engaged principally in producing same.—4.

Fire Brick.—Plants engaged principally in manufacturing same.—4.

Foods.—Plants engaged principally in producing, milling, refining, preserving, refrigerating, wholesaling or storing food for human consumption embraced within the following description: all cereals and cereals products, meats, including poultry, fish, vegetables, fruit, sugar, syrups, glucose, butter, eggs, cheese, milk and cream, lard, lard compounds, oleomargarine and other substitutes for butter or lard, vegetable oils, beans, salt, coffee, baking powder, soda and yeast; also ammonia for refrigeration.—1.

Foods.—Plants engaged principally in producing, milling, preparing, refining, preserving, refrigerating or storing food for human consumption not otherwise specifically listed (excepting herefrom plants producing confectionery, soft drinks and chewing gum).—3.

Food Containers. — Plants engaged principally in manufacturing same.—4.

Foundries.—(Iron.) Plants engaged principally in the manufacture of gray iron and malleable iron castings.

Fungicides. — See "Insecticides and Fungicides."

Gas.—See "Oil and Gas," also "Public Utilities."

Guns.—(Large.) Plants engaged principally in manufacturing same for the United States government and the Allies. —1.

Hospitals.—See "Public Institutions and Buildings."

Ice.—Plants engaged principally in manufacturing same.—3.

Insecticides and Fungicides.—Plants engaged principally in manufacturing same.—4.

Laundries.—4.

Machine Tools.—Plants engaged principally in manufacturing same.—2.

Medicines.—See "Drugs and Medicines."

Mines.—Coal.—1.

Mines.—Producing metals and ferro-alloy minerals.—2.

Mines.—Plants engaged principally in manufacturing mining tools or equipment.—3.

Navy.—See "Army and Navy."

Navy Department.—See "War and Navy Departments."

Newspapers and Periodicals.—Plants engaged principally in printing newspapers or periodicals which are entered at the post office as second-class mail matter.—4.

Oil and Gas.—Plants engaged principally in producing oil or natural gas for fuel or for mechanical purposes, including refining or manufacturing oil for fuel. or for mechanical purposes.—1.

Oil and Gas.—Pipe lines and pumping stations engaged in transporting oil or natural gas.—1.

Oil and Gas.—Plants engaged principally in manufacturing equipment or supplies for producing or transporting oil or natural gas, or for refining and manufacturing oil for fuel or for mechanical purposes.—3.

Paper and Pulp.—See "Pulp and Paper."

Periodicals. — See "Newspapers and Periodicals."

Public Institutions and Buildings.—(Maintenance and operation of.) Other than hospitals and sanitariums.—3.

Public Institutions and Buildings.—(Maintenance and operation of.) Used as hospitals or sanitariums.—1.

Public Utilities.—Gas plants producing toluol.—1.

Public Utilities.—Street railways, electric lighting and power companies, gas plants not otherwise classified, telephone and telegraph companies, water-supply companies. and like general utilities.—2.

Public Utilities.—Plants engaged principally in manufacturing equipment for railways or other public utilities.—2.

Pulp and Paper.—Plants engaged exclusively in manufacturing same.—4.

Railways —Operated by United States Railroad Administration.—1.

Railways.—Not operated by United States Railroad Administration (excluding those operated as plant facilities.)—2.

Railways. — (Street.) See "Public Utilities."

Rope.—See "Twine and Rope."

Rope Wire.—See "Wire Rope."

Sanitariums.—See "Public Institutions and Buildings."

Ships.—(Maintenance and operation of.) Excluding pleasure craft not common carriers.—1.

Ships.—Plants engaged principally in building ships, excluding (a) pleasure craft not common carriers, (b) ships not built for the United States government or the Allies nor under license from United States Shipping Board.—1.

Soap.—Plants engaged principally in manufacturing same.—4.

Steel-Making Furnaces.—Plants engaged solely in manufacturing ingots and steel castings by the open hearth, Bessemer, crucible or electric furnace process, including blooming mills, billet mills and slabbing mills for same.—1.

Steel-Plate Mills.—1.

Steel-Rail Mills.—Rolling rails fifty or more pounds per yard.—2.

Steel.—All plants operating steel rolling and drawing mills, exclusive of those taking higher classification.—3.

Surgical Supplies.—See "Drugs and Medicines."

Tanners.—Plants engaged principally in tanning leather.—4.

Tanning.—Plants engaged principally in manufacturing tanning extracts.—4.

Textiles.—Plants engaged principally in manufacturing cotton textiles, including spinning, weaving and finishing.—4.

Textiles.—Plants engaged principally in manufacturing woolen textiles, including spinners, top makers and weavers. —1.

Textiles.—Plants engaged principally in manufacturing cotton or woolen knit goods.—4.

Textiles.—Plants engaged principally in manufacturing textile machinery.—4.

Tin plates.—Plants engaged principally in manufacturing same.—3.

Tobacco.—Only for preserving, drying, curing, packing and storing same—not for manufacturing and marketing.—4.

Toluol.—See "Coke," also "Public Utilities."

Tools.—Plants engaged principally in manufacturing small or hand tools for working wood or metal.—7.

Twine.—(Binder and Rope.) Plants engaged principally in manufacturing same.—4.

War and Navy Departments.—Construction work conducted by either the War Department or the Navy Department of the United States in embarkation ports, harbors, fortified places, flood protection operations, docks, locks, channels, inland waterways and in the maintenance and repair of same.—2.

Wire Rope and Rope Wire.—Plants engaged principally in manufacturing same.—2.

Woolen Textiles.—See "Textiles."

(The term "principally" means 75 per cent. of the products mentioned.)

That there is considerable difference of opinion in the jewelry trade of New York as to the use of white gold as a setting for precious stones was indicated at a meeting of manufacturers. Arguments were offered in favor of the use of white gold both with and without precious stone settings, and a resolution submitted to the meeting which upheld the use of white gold when properly stamped. This resolution was referred to a committee.

Producers Want to Know Where Pig Iron Goes

A Very Close Watch is Being Kept to See That War Orders Have a Preference in the Matter of Distribution—Questions That Are Asked

NO. It's not an easy matter for us to keep going. We have a fairly large stock of material on hand, but it's going down rapidly. Our yards have not nearly as much pig iron and scrap as we generally carry, and it's not much of a job to see the day coming when we will have to curtail or quit entirely for a time." That was the opinion of a prominent stove manufacturer who was discussing the situation with this paper a few days ago. He had been interviewing a number of salesmen who were in touch with supplies, but he could get nothing definite that would help him.

"As a matter of fact the men who have charge of the distribution of pig iron in this district seem to have a lead on the government. They are already in control of the situation, and believe me the only chance you have to get a ton of pig iron is to have a contract that has a very direct bearing on the carrying on of the war. I was certain that the last time I went to the furnaces in Hamilton that I had put up a pretty good case for the stove maker, but I was simply asked if we could make a stove that could be shot at the German army in the place of shells. If so we could get pig iron. If not, we could not get any. We make a good many stoves, of different sizes and kinds, but we haven't anything that can be shot at the German army."

Questions That Are Asked

As a matter of fact the pig iron in this section of the country has been under control for some time, and in a very direct way, too. A questionnaire has been used, it being required that it shall be filled out in duplicate, one part going to the director of licenses of the War Trade Board at Ottawa, and the other to the company supplying the pig iron. The questions are as follows:

Please State

1.—The total tonnage of pig iron required based on your estimated monthly consumption from the first day of current month to December 31, 1918.

2.—What class of work this pig iron is to be used for and give the percentage of each class.

3.—What quantity of pig iron you now have in stock.

4.—What quantity of pig iron you have purchased.

5.—What quantity of cast iron scrap you now have in stock.

6.—What quantity of cast iron scrap you have purchased.

7.—The weight in pounds of your daily melt, not including scrap.

8.—The weight in pounds of your daily melt, including scrap.

9.—Approximately the number of melts each month.

10.—What castings you are producing each day directly connected with the government war programme and give weight.

11.—The percentage in weight of your melt now being used in producing castings directly connected with and necessary to the conduct of the war.

12.—If castings are being furnished by you applying on government orders direct, please furnish the order numbers; and if such castings apply on indirect government orders, give name and address of your principal.

The accuracy of the above report is certified to as being substantially correct to the best of my knowledge and belief.

Firm............ ....

Address ... ...

Date............ Signed..........

THE VALUE OF THE TRAINING COMES OUT AFTER THE WAR WORK

Editor Canadian Machinery:

Sir:—My reply to "Mechanical Engineer" in the Sept. 26th issue is "not at the present time." He and the thousands of other head workers have every reason to feel injured at the present time under present wage scales, For the time being, the years of training and self-abnegation count for but little alongside of the mere ability to stand before a machine and keep its yawning maw filled with chunks of metal. The men who have planned, whose brains have made it possible for every cobbler and barber to turn out a lot of accurate work the first day in the shop, they have not received a just reward nor a fair proportion of the compensation which is rightfully their due.

It is a part of the epoch through which we are now going. The comforting thought is in the future, for of such conditions, "that too will pass." Other lines than mechanical are experiencing the same thing. Here in the U. S. with the railroads under Government control we find ignorant laborers fairly blustering with the high wages thrust upon them. Women clerks are taking the place of men clerks who have gone to the front, and are receiving upwards of a fifth more than the experienced men did before the war. Experienced stenographers in law offices who considered themselves well off at $15 per week leave and go into railroad work of the easiest kind at a fifty per cent. greater salary. Girls who couldn't make change in stores make good on such war work.

In machine shops the tale is the same. Foremen and superintendents are hard to get. And why shouldn't they be, when toolmakers and machinists are allowed to earn double the money. And directing a force requires a lot of head and training and patience. One of the ablest men in the heat treatment of steel in the east has been working for me for about a year doing light bench work; in applying for a position he said, "I want a job where all I have to do is my work—this planning and designing, this bucking the queernesses of human nature which I have done for a lifetime is the most wearing, most discouraging of all kinds of work." And so it is that some big industry loses a man that is worth $5,000 a year to it because it makes his road too hard for endurance, while he in turn is smoothing the path that hundreds of workers might earn big money and the coffers of the house be correspondingly swelled.

But when the war is over and the world settles down to peaceful pursuits again, then the engineer and executive will come into his own again. It is an impossibility to avoid some sort of a re-construction or transition period during which the manufacturing machine shops at least will disgorge their workers as formerly they drew them in. It takes years and months to change to any other line, just as it did to start munition work, and through all of that time the piece worker will be laid off. After indefinite lay offs and months of looking for work, the barber will naturally drift back to his chair and the cobbler to his bench.

Mechanical work appeals to most men and recent conditions have been the entering wedge long sought by thousands of them. These men will remain. They, reinforced by the men who return from abroad and skilled machinists on this side, will constitute the working force of the future. Their number and the slowing up of the re-construction period will automatically lower the wage scale, possibly very near to what it was four years ago.

The engineer and executive, however, will be more necessary than before Brains have always been the most excellent of hard time assets. Engineers can and will command more money than ever before, for the simple reason that under competition the best thrives and many of the makeshifts and misfits of to-day cannot continue. To meet the competition and keep men at work, old methods must be better and new devices must be brought out. To make these possible is the work of the engineer, work for which he will be equably paid.

"They copied all they could copy, but
they couldn't copy my mind
And I left them sweating and stealing
a year and a half behind."

—Donald A. Hampson, Middletown, N. Y.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

REAMER AND ARBOR WHICH ARE GOOD PRODUCERS

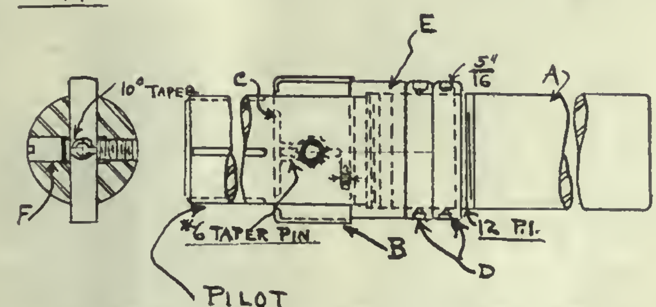
By F. Scriber

A REAMER made of flat stock and having two cutting edges which may be expanded to compensate for wearing, is illustrated in Fig. 1. This reamer was used in a turret lathe and the expanding feature makes it an economical tool in the utilization of high speed steel.

The boring bar itself A is made of machine steel, and is hardened and ground. The reamer B goes through a slot in the bar and is forced against the slot C, by means of the two adjusting nuts D, one of which is used for locking the other to prevent it from turning. Between the reamer and the collars a hardened and ground ring E is placed, this is a slip fit on the bar and is used to obtain a square surface so the reaming cutter will be forced squarely against the end of the slot. For holding the cutter central in the bar a tapered screw F is used.

When it is desired to adjust the cutter to compensate for wear on the edges this is done by removing the cutter from the bar and driving in the tapered pin which is indicated as number six, this expands the cutter, which is split almost through, or within ⅜ of the back edge as shown by the drawing, the cutter is then replaced in the bar and is reground to size.

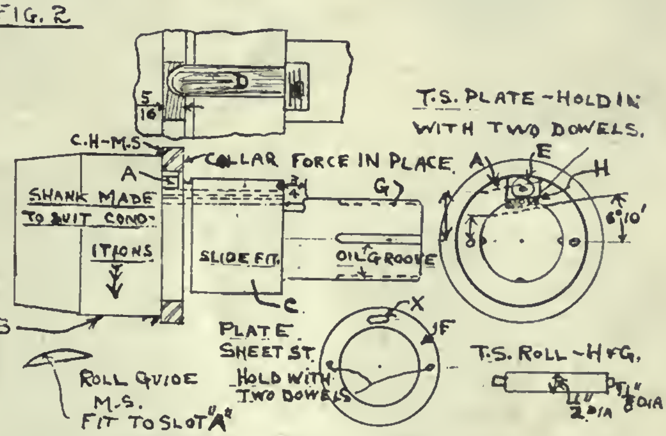
FIG. 1



EXPANDING REAMER OF THE FLAT CUTTER TYPE

In Fig. 2 an arbor of the roll grip type is shown, this arbor is held at B, in the spindle nose of the turret lathe, and is marked "shank to suit conditions." The work to be machined goes over the diameter C, and is pushed up against the collar which is shown in section. In this diameter C a slot is cut D, and in this slot a roll E is placed, this roll is also shown in the lower right hand corner of the illustration It will be noticed that both ends of this roll are turned down, the reason for this is that one of the ends turned down fits under the collar which is shown in section, while the other end fits in the slot X, of the plate F, shown below the arbor, this plate F slips over the end of the arbor G, and is held in place by the dowels noted.

FIG. 2



ROLL GRIP ARBOR FOR LIGHT WORK

In the lower left hand corner of the illustration a part indicated as roll guide is shown; this fits under the sectioned collar and helps to keep the roll in place. It will be noticed from the end view that a plate, H, is set in the slot at an angle, and the purpose of this will be understood by noting the operation of this arbor in gripping work, as, for instance, the work having a hole in it is slipped over the arbor at C, the arbor with the work in place revolves in the direction of the arrow, and when the cutting tools bite into the work, the roll E is forced up the tapered plate H, thereby causing the roll to grip between the hole of the work and this plate. This securely holds the work in position and drives the same under the cut.

This arbor has been found particularly adaptable for short operations where the cuts are not very heavy, as under heavy cuts it has been found that the roll will sometimes bite into the hole of the work, thus marring the same. Both of these tools used under proper conditions are found to be good economical producers.

THE CARE OF SCALES

By W. Schaphorst

Engineers and others in and about the plant often use scales in various ways without giving them much thought. It is generally assumed by the average engineer that if a scale "balances" before the load is put on, the weight registered will be "accurate," but such is not always the case. Much depends upon the care given the scale between weighings.

It might, therefore, be a good plan to say a few words about scales in these columns for a change.

In Figure 1 is shown a so-called "knife-edge." On top of the knife-edge is the bearing. Both the bearing and knife-edge should be made of the same material, of equal hardness. The harder and stronger the material used the better, in most cases.

However, it is evident that we must have more than mere "line contact" when there is any sort of load on the scales. The knife-edge on a jeweler's scale may be so sharp that one could shave with it, but on the high capacity scales the knife-edge is really nothing more than a blunt edge, and in the largest scales is actually a flat surface without semblance of a point or "edge."

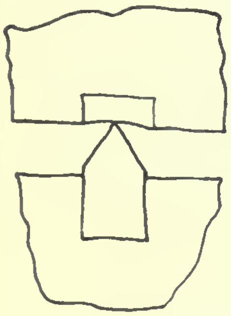


FIG. 1

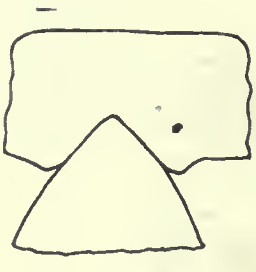


FIG. 2

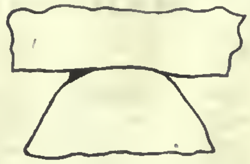


FIG. 3

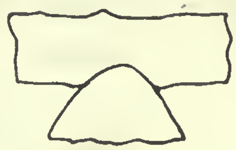


FIG. 4

Yet, they are "called" knife-edges, although the proper word would be "pivots."

Figure 2 is an imagined enlargement of what occurs where the knife-edge is harder than the bearing. It is evident that the principal deformation will take place in the softer metal.

Figure 3 shows a case where the knife-edge is soft and the bearing is hard. The knife-edge, of course, will be "blunted down" pretty much as shown.

Figure 4 shows a case where both metals are of the same hardness. That is the "ideal" case, although it would be much nicer if we could get away from surface contact altogether. Theoretically, the ideal case is a "line" pure and simple. If the line could be attained in actual practice things would be simplified very much for the designers of scales.

To keep a pair of scales in good condition it is, therefore, important that they be never overloaded. Overloading may deform the knife-edges of bearings permanently. Never allow a weight to drop heavily upon the scale platform, for blows are liable to deform the edges, too. And never allow a heavy weight to remain long upon the platform. Give the knife-edges an opportunity to return to their normal shape as soon as possible after the weighing. A long-sustained heavy load will cause the knife-edges to "flow" and remain deformed permanently.

To date, the best metal for knife-edges for use on high capacity scales is the high-speed steel that is used so much in machine tool work. A new metal called stellite, however, has lately been put on the market as superior to high-speed steel. It is exceedingly hard and will scratch the hardest hardened steel. There is no iron in stellite at all except as an impurity. Stellite is very likely the coming metal for knife-edges. It has another advantage over steel in that it does not corrode.

BENDING CAST IRON PIPES

By M. E.

A successful bending of large straight cast iron pipes was recently effected in making the line of cast iron pipe which it had been decided to lay to convey water from the Guayabo River to the town of Present, Cuba. By mistake no sleeves or curves had been ordered. The canyon through which the pipe passes for a distance of about two miles from the dam is crooked, making impossible such easy curves as would be made in the pipe joints. As it might have taken several months to secure additional special pipes, the local engineer decided to bend some of the straight cast iron pipes. The Cuban workers had frequently bent steel or wrought iron pipes at their sugar mills, and they followed the same course of procedure with the cast pipes, with entire success, as they did not break or spoil a single pipe. The pipes were bent to various radii, the shortest being 50 feet. A cradle of old rails was first constructed with the desired amount of curvature, and a fire of hardwood was built under and around the pipes. Six or eight pipes were bent at a time. In one and a half or two hours after starting the fires, the pipes were hot enough to bend and settle under their own weight on to the cradle prepared for them. The pipes were 10 in. in diameter with 9-16 in. thickness of shell. their weight being about 760 lb per 12 feet length.

HAMMER HANDLES

By M. M.

In a large number of places it is customary to supply both hammer and file handles to the men on demand, this often leading to considerable waste, particularly when the cheapest kind of handles, irrespective of quality are provided. So far as files are concerned they should be issued with the handles fitted, charging each man with the issue and crediting him with the return of the old file and handle to the stores. The file probably goes to the scrap head, but the handle can be used many times, and if not returned to the stores the user should be called upon to pay for it. On regard to hammer handles there should be a man attached to the stores who can handle hammers properly, and instead of giving out handles to all who apply for them, the hammer, with the broken handle, should be given to the proper man to be fitted with a new handle at once. Properly put on, a hammer head should not leave the handle, and as the user gets used to the "feel" of the hammer he takes care of it, a thing he does not do when the hammer is a bad fit in the handle. Either well-seasoned hickory or cleft oak handles should be used, and the size should be suited to that of the hammer to which it is attached. Handles are only minor items, but they count for a great deal in doing work.

PURE SHEET-NICKEL

Pure nickel should not be confounded with the inferior metals usually sold as nickel, which consist mostly of steel, brass or German silver with a thin plating of nickel. Nickel is essentially an American product. For many years it has been a general practice to have the ore which has been mined in this country and Canada reduced to its various forms by European manufacturers. Previous to the war most of the material imported into this country as foreign stock was the American metal worked into the form of sheet, strip, and finished articles of manufacture by foreign concerns.

Pure nickel does not rust nor oxidize, and consequently every danger of poisoning, generally caused by verdigris, is eliminated. Neither will the metal tarnish like silver or some of the alloys, such as German silver, and, even though the surface be injured there is no danger of corrosion resulting as in a plated article.

While not so good a heat conductor as aluminum, nickel utensils are made of a thinner material, which more than overcomes the difference. Pure nickel has a melting-point of abut 2,600° F., whereas aluminum has only one of about 1,200°. There is not the same possibility of softening under constant use. The metal is also much more resistant to the action of the acids commonly found in food products. The silver-like appearance of pure nickel does not change in use.

In the chemical field there are many uses for this metal. The surface of pure nickel is not attacked by acids nor alkalies, in the dilute form usually encountered in ordinary service. In fact, it is practically immune to the attacks of all alkalies, regardless of their strength, and is largely resistant to the action of most acids. Nickel has a high tensile strength, and in the sheet form. being homogeneous throughout, is ductile and easily formed by spinning or stamping. No special equipment is necessary for manufacturing articles from these sheets, the same tools and metals being employed as with German silver and hard alloys.—The Journ-Franklin Inst.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

CONTINUOUS PHOTO-PRINTING MACHINE

The illustrations show a continuous photo-printing machine, used in conjunction with an automatic washing and drying machine, both of which were designed and constructed by the C. F. Pease Company, of 213-231 Institute Place, Chicago, Illinois, U.S.A., and are sold under the trade name "Peerless." With these machines a single operator can print, wash and dry 100 linear yards of blue prints per hour, during which time the apparatus consumes 7 units of electrical energy, 60 gallons of water, and 50 cubic feet of gas. It is, of course, quite possible to use the machine for part of the time only if such a large output is not required. The operator's time can then be occupied in other ways, and the working costs correspondingly reduced. Prints can also be made on separate sheets of sensitized paper, instead of in continuous rolls, if desired. Fig. 1 is a front view of the machine, and Fig. 2 is a side view, showing the course of the paper through the apparatus. The table from which the tracings are fed into the machine will be seen in Fig. 1, and beneath it are two horizontal spindles which carry rolls of sensitized paper of different widths. The tracings and paper are carried upwards over a cylindrical segment of thick plate-glass by means of an endless canvas belt, best seen in Fig. 2. Springs are provided to keep the belt tight, so as to ensure good contact, and side travel

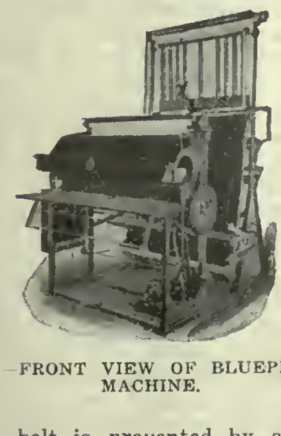


FIG. 1—FRONT VIEW OF BLUEPRINTING MACHINE.

of the belt is prevented by a special device. The belt is driven by a small electric motor, the speed of which is controlled by a rheostat placed on the right-hand side of the machine; both motor and rheostat are clearly shown in Fig 1. By means of the rheostat, the speed of the paper can be varied from 4 in. per minute, which allows sufficient exposure for the slowest negatives and black-line prints, up to 6 ft. per minute.

The exposed paper can be examined immediately it has passed the glass segment, so that the speed can be adjusted to give the right exposure before any prints have been spoilt. In front of the glass is a bank of five arc-lamps, of the enclosed type, fitted with aluminum reflectors. Each lamp is separately wired and controlled by switches, which are enclosed in a metal box on the left-hand side of the machine, as shown in Fig. 2. The number of lamps employed can thus be varied according to the width of paper being used. The motor-switches are also enclosed in the same box, and

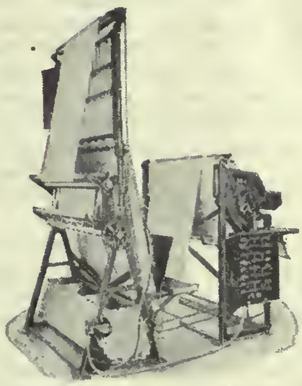


FIG. 2—SIDE VIEW OF MACHINE.

all the wiring is encased in steel tubing. A small electric fan of the pedestal type is mounted on top of the switch box. This fan, which can be distinguished in Fig. 2, drives a current of air in a transverse direction through the machine, in order to carry away the heat from the lamps.

Fig. 3 shows how easily accessible the lamps are for trimming and cleaning, and also illustrates how they may be turned back to facilitate these operations.

After printing, the tracings are delivered into an enamelled iron trough in front of the machine, so that the operator can remove them without changing his position. This trough, which can be seen in Fig. 1, also serves to catch the exposed sensitive paper if the printing machine is used independently of the washing and drying equipment, as is often the case. Usually,

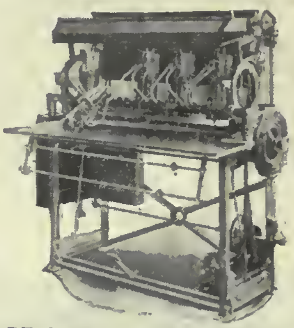


FIG. 3—REAR VIEW OF MACHINE SHOWING ACCESSIBILITY OF LAMPS.

however, the exposed paper passes over a roller at the top of the printing machine, and thence to the washing and drying machine, as shown in Fig. 2. This part of the apparatus is driven, by means of chains and sprocket wheels, from the motor of the printing machine, and in it the paper is first washed by a spray of pure water, and afterwards treated by a weak solution of potassium bichromate. This solution is contained in a galvanized tank placed in the base of the machine, and clearly visible in Fig. 2.

From this tank the solution is circulated by a small rotary pump, driven by an electric motor, having a vertical shaft, and delivered on to the paper through a flexible pipe; an inspection of Fig. 2 will make the whole arrangement clear. After a further washing with pure water, the paper passes upwards in front of the drying device, over a roller at the top, and down at the back of the machine. Here it passes through a system of rollers which carry a series of elastic bands, running in opposite directions, and forming part of a device for rolling up the finished prints. These are wound up on a shaft, but the end of the paper, as it descends from the roller at the top of the machine, is formed into a loose roll, and this roll of finished prints entirely free from wrinkles and distortion, being placed upon the bands, continues to roll itself up automatically until the operator wishes to cut it off and start a new roll.

ALL-STEEL WORK STAND

The field of the work stand has become so varied and its use so general as to render a definition of its purposes, or argument in favor of its employment, superfluous.

The work stands illustrated are made of steel throughout, their unique construction affording ample strength with minimum weight, stability and durability, without clumsiness.

The two legs at either end are formed by a single steel angle, whose continuation across the top adds both rigidity to the construction and a finish to the rack's appearance.

The trays are of such material and design as to render them remarkably stiff and substantial. The strengthening influence of the 2-in. flange along sides and back is supplemented by a formed hem, which also supplies a smooth finish to edge of tray. Forward edge is turned down to afford most convenient access to, and facilitate cleaning of, trays. At the corners are welded gussets by which trays are bolted to uprights and given additional support. Stand has no sharp corners or ragged edges by which accidental injury might be sustained.

Stand may be had with two or three trays and with or without drawer. Height to top tray, 32 inches. Size of trays, 16 inches by 26 inches.

ALL STEEL BENCH STAND

A hem of triple thickness around its upper edge and the welding of all joints combine to produce a drawer of remarkable strength and rigidity.

The slide ways are welded to under side of top tray, and give to drawer a smooth movement free from binding or cramping tendency.

Drawer handle is of generous size with a shape of special design, affording a very comfortable handhold.

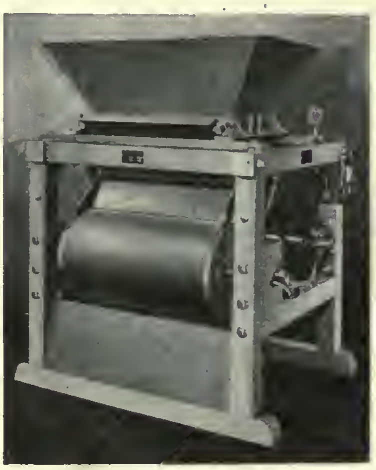
A cylinder lock of good grade, with two individual keys, is provided. Master keying if desired may be had at cost. The possession of master key by foreman will prevent the stowing of contraband in drawers.

The stands are shipped knocked down and may be most easily and quickly assembled as follows: Insert bolts in one side angle and lay it flat on floor or box. Place trays on edge in proper positions and add nuts. Apply other side angle to upper edges of trays and insert bolts. Then stand tray upright and firmly tighten bolts.

These stands are manufactured by the New Britain Machine Co., New Britain, Con.

MAGNETIC SEPARATORS

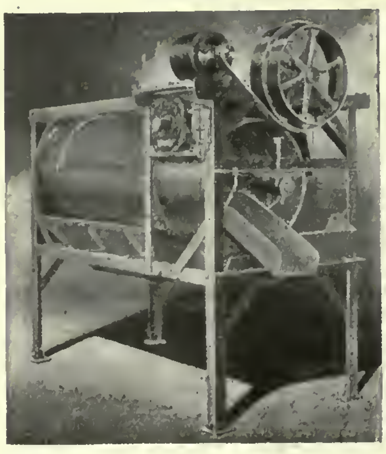
THE Magnetic Mfg. Co., Milwaukee, Wis., are manufacturing a variety of magnetic separators for use in the foundry. One of the great advantages of using a machine of this nature



MAGNETIC SEPARATOR.

is that the sand is left in a clean and uniform condition and may be used in various ways in the foundry. The machine is very simple to operate and does not require skilled labor to get the best results. It will not clog and will take care of any material that would be handled with a shovel, such as stray brick, gaggers and other coarse material usually found in foundry refuse. All parts are accessible for inspection without dismantling.

The material is shoveled into the machine at the upper end of a revolving screen. Sand and fine material passes through the screen into a hopper and may be caught into a wheelbarrow. The other material passes on through the



ANOTHER TYPE OF SEPARATOR.

cylinder and comes in contact with magnetized blades where the iron being attached to the blades is carried up to top of cylinder and then discharged into a chute.

One of the commendable features in this separator is its simplicity. There are no friction wheels or level gears to wear out or give trouble. There are only four bearings on the machine. The two main bearings supporting the revolving cylinder are properly proportioned and are made dustproof. The only other bearings are the two small countershaft bearings located on the top.

NON-CRUCIBLE MELTING FURNACE

The Hausfeld Company of Harrison, Ohio, is the manufacturer of the furnace herewith illustrated, which was designed particularly for the melting of brass and kindred materials. It is of the open-flame, non-crucible, tilting type and has a capacity of 400 pounds.

A "complete unit" consists of the furnace proper—lined ready for service—equipped with a Maxon Premix Burner, a one-half-horse-power motor (D. C. or A. C.), a patented fuel oil-feeder with burner and a pouring ladle, all as shown in illustration above. No equipment other than piping to the gas and the fuel oil reservoir is necessary. The furnace can be had without the fuel oil feeder and burner if desired, but for emergency purposes in event of failure of the gas supply the complete unit is almost essential.

One of the advantageous features of the complete unit is the facility and speed with which a change from gas to oil fuel can be made. As stated in a descriptive booklet of the furnace, a copy of which can be had upon request:

"The speed with which a change from gas to oil fuel, or vice versa, can be made may be best explained by the statement that a heat started and half finished by gas was finished by oil as the fuel in practically the same time had the change not been made." The change is accomplished by loosening two bolts, sliding the oil feeder housing forward, thereby placing the feeder into gear with the motor, tightening the bolts, removing the plug in the top of the elbow attached to the drum, and inserting the oil burner.

Although of compact form, occupying the minimum amount of space, the oil feeder develops a lift of over 18 feet, and has a delivery pressure of over 60 pounds. It is equipped with a relief valve capable of regulation, the outlet of which is piped to the oil reservoir, permitting the return of any excess quantity of oil.

The patented oil burner provides for heating the oil prior to its injection into the furnace. The location of the needle point seat being at the extreme end of the outlet causes a spray of wide range. To increase this range and break large particles of oil, a small division bar is located directly in front of the burner outlet. With this arrangement every drop of oil is satisfactorily utilized, and the oil being preheated and so finely atomized results in quick ignition.

As the flame, whether from gas or oil fuel, covers the entire inner surface of the furnace, a uniformly distributed heat is obtained and the metal is thereby melted largely by reflection of the heat from the walls, similarly to the effect obtained by melting in crucibles.

The plain shape of the drum facilitates relining. The bricks furnished have locking joints to prevent the seepage of metal. The manufacturers claim that both the brick and cement employed have excellent refractory qualities and withstand by far a greater number of heats than any other with which they have experimented.

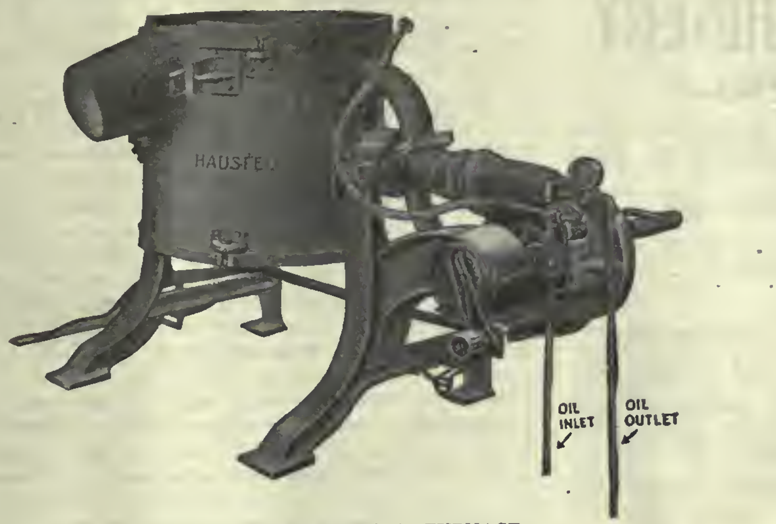
Depending upon the character of the metal to be melted, from 9 to 12 heats can be obtained every 9 hours.

With the furnace drum in a vertical position, the furnace can be charged with gates and other scrap, while the blast is on, the metal being thrown on top of the drum where it preheats and then shoved into the charging hole, by means of a bar, as fast as desired.

The pouring ladle is located directly over the pouring hole where it remains during the melting of the entire heat. By this arrangement the ladle is heated to a temperature almost equal to that within the furnace and a separate preheating furnace is dispensed with. It also materially aids in retaining the heat within the furnace.

The furnace is tilted by means of a handle of a length sufficient to provide ample leverage for easy manipulation. The locking arrangement is spring actuated and tends to keep a bar on the frame in constant engagement with the teeth of a sector attached to the drum, securely holding the drum in any position desired. The release of the lock is effected by foot pressure on a treadle at the base, permitting the use of both hands for tilting or rocking the drum. For convenience, a double treadle is provided, one extending to the front and the other to the rear of the operating side, so that when tilting the treadle most convenient is used. Upon release of the foot pressure the drum is instantly locked.

The Hausfeld Company guarantee efficient and satisfactory results if the furnace is installed and operated in compliance with instructions furnished.



NON-CRUCIBLE MELTING FURNACE.

CANADA'S AFTER THE WAR TRADE

Call For Organization of Business Interests

In the report on Canada's trade in 1917, the Deputy Minister of Trade and Finance emphasises the urgent need for preparing commercial organizations for after-war trade.

His statements, although directed towards the business men of Canada, are applicable to any country that intends to occupy a leading position as an exporting country after the war. For this reason, the views enumerated by the Deputy Minister are quoted below. In his report he states:—

Germany's Economic Position

When hostilities cease and peace is declared, if the cartel systems of Germany be co-ordinated and in reality become not only nationalized, but also become State monopolies, as has been announced is the intention, private firms and individuals will find the most formidable possible competition in every market in the world. Such monopolies, backed up by the concentrated strength of all the banks of the German Empire, will be able to purchase in large quantities under the most favorable conditions, and to sell at prices and upon terms to render competition extremely difficult, if not impossible. Thus will Germany wage economic war.

When such commercial war begins, Germany will have its shipping, now locked up in its harbours, its factories unscathed by the ravages of war, and hundreds of thousands of labourers returning to commercial pursuits, ready to work for the merest living wage, but Germany must look abroad for many raw materials vitally necessary to her commercial existence, for many of which she is dependent almost wholly upon her present enemies. To a lesser, though important, extent she is dependent upon the British Empire, and in many important respects upon Canada also. In fact, so far as Canada is concerned, apart from her grain exports, the nickel and asbestos production of the Dominion are greater than all the rest of the world put together.

In considering, however, the statement frequently made that the German factories will be ready at the close of the war to offer keen competition to the world, it may be well to draw attention to a more recent statement which, if true, considerably alters the general opinion as to Germany's position. That statement is to the effect that many factories in Germany which have not been engaged in war work have been stripped bare of their machinery, which has been transferred elsewhere. Under these circumstances, a factory which has been closed down cannot be presumed to be able to resume work immediately on the restoration of peace. Such factories must be rehabilitated with new machinery, the manufacture of which will require considerable raw material.

Organization Imperative

Is it not, therefore, urgent that the various industries in Canada, especially those producing food and raw or semi-raw materials, should organize upon such a basis as will conserve these products for Canada and the Empire? If we let them go loosely to the first or highest bidder—and Germany with exhausted stocks of raw materials will be in the forefront as a buyer—the demand will naturally lead to extravagant prices, which, of course, will re-act upon ourselves and increase the cost of production and manufacture in Canada.

Collection of Statistics

While no one can forecast what the conditions of business may be when the war is over, the time has arrived to prepare for every possible eventuality by widespread organization of every industry in Canada. Each industry should prepare complete and accurate statistics of the most exhaustive nature with respect to itself, so that if necessary such information will be available not only during the progress of the war, but also when the Government is called upon to study tariff problems at home and tariff arrangements abroad.

Co-operation in Export Trade

Such organizations are not inferred to be in the nature of trusts to dominate prices or to restrain trade in Canada, but for the purposes of assisting and advising the Government with all possible information in respect of such industry, and also engaging in export trade. Co-operation in export trade will be necessary to meet similar foreign export syndicates. Such combinations develop men of initiative and constructive genius.

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Keep Up That Wall of Steel

THE Germans may talk peace—they may get Austria or Turkey to hoist the white flag—but the shell factory gives the answer of the Allied nations.

Did you hear of any shell contracts being cancelled on Monday morning on account of the German peace talk of Sunday?

Did you hear of the call being any less for 18-pounders, the 75-m.m., the 155-m.m., the 9.2 or the six-inch?

Not a bit of it. The forging and the machining were going on just the same as though there had been no peace talk, and the shipments were going on with the same unfailing regularity.

As a matter of real fact, the Kaiser's peace kite didn't get the eyes of the world long enough to make the munitions workers miss a single operation.

And there's no let up in the Allied programme that calls for more than capacity production of the steel plants of the continent. Every day sees the figures shoved up a few more hundred or thousand tons; every day sees another non-essential line told to suspend operations; every day sees a customer told that there's no steel or iron for him because he's making a line that can wait; every day sees the whole commercial and mechanical fabric of the continent keyed up tighter and harder for ultra-maximum production.

The men who control the steel output of this continent know the enormous tonnage that is being turned out—they know it is a case of steel or men—the more steel the lower the casualties, and they are seeing to it that the wall of steel that precedes the march of the Allies eastward is tremendously efficient and perpetually maintained.

The whole business of the nation has been thrown out of kilter, and it is going to stay out of kilter. The war needs occupy the centre of the arena, and there's no disposition to crowd them to one side.

The Kaiser and his war lords started this war; they lived it years ago; they planned for it and they plotted and schemed for it. But the Kaiser and his war lords are not going to finish this war. That part of the performance is going to be attended to by the Allied nations of a free world.

The Allies are not fighting for the sake of fighting. The lives of their men are dear and precious to them. They will not fight five minutes longer than is necessary, neither are they disposed to cease five minutes before they have accomplished the task to which they have set their hand.

The latest indications from the front should be a challenge to the munitions workers of this continent.

If you are making shells, make more of them and make them better.

You can hasten the end of the war by keeping up that wall of steel that goes on ahead of the Allies.

Don't bother about the Kaiser's peace proposals. The diplomats of the Allied powers are acting in concert and in complete accord, and they are not going to betray the trust that is theirs.

Peace will come, and it may come quickly. Against that is the chance that it may not. Base your efforts on the latter. Better to have a pile of shells left over than that there shall be a break in the wall of steel that the munitions workers are building on that Western front.

Better Play It Safe This Time

MECHANICS are these days receiving exceptional wages. Some of them, most we hope, are salting away neat little sums for the rainy season. Among the thrifty, Victory Bonds are regarded as one of the premier investments, and the new issue will undoubtedly be very largely taken by this class. But occasionally one hears of cases in which men have not been careful—when, in fact, they have been reckless as regards their own futures and those depending upon them. An actual instance that stands out is that of the mechanic who was a bear to work and who was making something like $3,000 a year—probably more than the superintendent of his shop was receiving. He was, in fact, a good workman. This man purchased a car—not a flivver—a car. One night while out driving with his wife, he met with an accident. The car turned turtle; he was killed and his wife was seriously injured. The after records revealed that the man owned the car—an $1,800 machine. It was paid for. In the home there was a piano on which two payments had been made; there was a life insurance policy for $500 and a chattel mortgage of $400. The machine had been smashed—it was worthless. This was the record of a man who had been making exceptional money—and this is the record of what he did with it—practically nothing to place on the credit side against disaster. There are many men who will say it is nobody's business what they do with their money. Probably not; but to a good many others the good old moral will appeal: Buy Victory Bonds and give the clouds a silver lining.

Visitor—And what caused this sad case?
Helper—That sir is a journalist who went to write up the Russian situation."
—F. A. G. Racey in "Montreal Star."

Protection Needed For the Public

THERE are controllers for fuel and for food. There are officials to see that people don't eat too much, and there are others to see that they don't burn too much coal.

The country is sadly in need just now of a controller or some such official whose special duty it will be to see that the general public don't get soaked when they come to spend their money.

The people who need protection right now are the people who spend their money and get in return an article that is a fraud and a scandal. People need protection against shoes that are sold as leather, and which in reality have only the merest touch of leather to cover up a lot of substitute. They won't stand up against wear. And yet they are sold in the open market and at a good price.

People need protection in the purchase of clothes. The average purchaser is not an expert in this business. He cannot readily detect shoddy. And yet he puts up his good money for the clothing of himself and his family, only to find that he has paid a good price for something that is scandalously distant from what he was led to believe.

"Get the money" seems to be the big word in too many business concerns now. The idea of "service" is being crowded so near to the back door that it's not going to take a great deal of coaxing for it to depart entirely from the premises.

"Get the money." The people have it now. "Get the money." Never mind what follows. "Get the money." There's a new bunch of suckers coming on the market every Monday morning. "Get the money." Don't worry about the man who is spending it—he's supposed to have his eyes open.

There are men and firms who are doing business in an honorable way. Against such the public needs no protection. But in this age of money-grabbing shysters there certainly is need of ample protection against the gang of exploiters that are foisting their shoddy rubbish on the market.

AND now the report comes out that the prune crop is going to be a failure. Maybe so, but there's never a failure of the prune crop that's swished about in the boarding houses.

* * *

U.S. has placed soft drinks, pianos, corsets and coffins on the non-essential list. Well, as a matter of fact, there's a lot of folks around who have got along without any of this stuff.

* * *

SULPHUR is getting scarce. So scarce, in fact, that the chances seem to be much against the youngsters getting their 1919 spring tonic in the form of sulphur and molasses. It's a great age to be livin' in.

* * *

THE Secretary of State for Canada has stopped the publication of the Robotchyj Narod. Of course he put it down in writing so it didn't hurt him much.

* * *

THE Probs. in a Toronto paper the other day read: "Thursday—Mostly fair, with a few showers, stationary or slightly rising temperature." So it could either be fair or showery, same or higher temperature. The weather man was taking small chance of spoiling his rep. that day.

* * *

KEMPSMITH Komments, the house organ of the Kempsmith Mfg. Co., Milwaukee, Wis., has a number of names on its honor roll. Here are a few of them: John Samolinski, Joe Koniecki, Max Wojczak, Vincent and Arthur Wielant, Joe Vuchmanavich, Alfred Weisbecker. And they all line up under the name of "Yanks." The German menace is just as acute to a Vuchmanavich as it is to the most Simon pure New Englander that the country can boast.

A Vision of Former Dinners

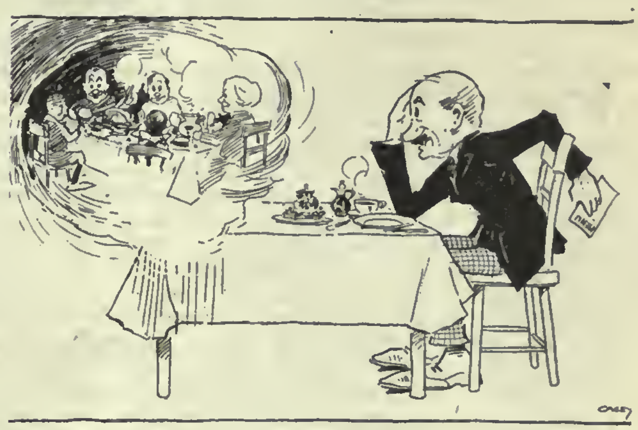
WHEN we go out to eat these days we have to sit and wonder, if food controller's hit the list with lightnin' and with thunder, or if he's put some more laws on to choke us from our hash, or if he's took from us our oats, our hay and our bran mash.

And when I see the sugar lump I sit and heave a sigh, for you could stick the bloomin' thing right edgeways in your eye.

And likewise bread is trimmed up thin, and butter, oh by heck, there aint enough doled out to grease the hair upon your neck.

Oh, I like to sit in times like these, and back up twenty years, to them there days what come along and boot away my tears—to the good old days of harvest homes when tables used to groan, and when we ate full to the neck for a quarter of a bone.

We used to take the punkins then, the corn stalks and the beets, and decorate the church throughout, the pulpit and the seats.



And put the big potatoes there, likewise the apples red, and cabbages as big and hard as was the deacon's head—and twine the oak and maple leaves, and spin the golden rod, and have a sample of most things what sprung from out the sod.

And then we had the harvest home—come back once more that night—when stuff to eat was piled up high and tucked in good and tight.

We ate some turkey and some ham, some chicken and some pie, we had a heap of sandwiches heaped up both thick and high. We ate, we did, until we groaned, and then we ate some more, and every course that came along we hollered out "encore!"

And after all that there was done they'd clear away the wreck, and all the preachers round about would climb upon the deck, and tear off jokes ten years of age and try to speechify on top of fourteen kinds of meat and sixteen kinds of pie.

There weren't no food controller then a-hangin' round the place, to see how much you gathered up and shoved into your face.

I'd like to be a kid again just for one harvest home, with sawhorse tables loaded up until they'd creak and groan—with punkin pies and chicken too, with home cured country ham, and best of all, by jing, there weren't no food controllin' man.—ARK.

Tin is coming down to where it will soon be on speaking terms with the rest of us. Not long ago it had reached the dizzy height where a pound was worth well nigh $1.50. Now it can't quite get its chin up to the dollar mark even with one toe on the ground. About the time tin hit the $1.50 mark there should have been a couple of lynchings.

* * *

THE war and its ravages has made a great demand for artificial limbs. And now, because metal is so scarce, they're talking of putting wooden legs on sewing machines.

MARKET DEVELOPMENTS

Peace Talk Has Made No Difference Here

There is Still a Very Keen Demand For All Sorts of Equipment, Especially in Connection With 155-mm. Shells—Ship Programme is a Big Business Item in Canada at Present

PEACE talk has not made much impression on the programme for the speeding up of the production of munitions. In fact the actual operations have not been interfered with at all. There is just the same demand to-day as there was before the week-end peace talk, and there is the same uncertainty regarding delivery dates, due to the tremendous pressure under which the makers of munitions equipment are working.

It is a poor week when some person has not a new guess as to the amount of business that will be handled in the future by the war contract shops of the Dominion. One report has it that U. S. manufacturers feel that they are in a position to handle the shell programme, and they desire no more business to come to Canada. As a matter of fact munitions business is not coming to Canada because the U. S. firms want to send it here, but because the munitions shops in Canada are right now keyed up to a wonderful degree of efficiency in producing shells, and the government that wants good shells at once can get them from the Canadian contractors. The largest orders for equipment now have to do with the production of the 155-m.m. shell, which is an American order.

The curtailment of iron and steel to those concerns making a product "that can wait" continues. And as it continues the industries are displaying a faculty for keeping afloat that is indicative of Canadian enterprise. Makers of sewing machines are having a hard time securing the supplies of pig iron they need to make up their proper mixture with scrap, so they will shortly turn out machines with wooden legs, saving quite a bit of iron in this way and sacrificing nothing in the way of strength and rigidity in construction.

The big demand continues to be for steel plate. The making, shipping, punching and putting together of the steel plates for the vessels now under construction in Canada has developed into a business that few people apart from the trade fully realize. For instance here is what it means to the transportation companies having the transcontinental haul: For the material that went into the construction of a 4,200-ton vessel in Vancouver (the largest part of which would be plate) the company paid out between $75,000 and $80,000 in freight charges.

The scrap metal trade is dull. Dealers are not buying heavily. In fact in some cases they are accepting shipments simply in order to protect their credit and keep in the market. Large volumes of scrap are disposed of direct from seller to consumer. Dealers fear that industries that cannot get into the iron market, may cease buying scrap because they cannot get pig enough to complete the mixture. At any rate the trade is well nigh stagnant as far as big deals are concerned.

PEACE TALK HAS HAD LITTLE EFFECT IN THE MONTREAL MARKET

Special to CANADIAN MACHINERY

MONTREAL, Oct. 19.—Despite the reported willingness of the German Government to meet the Allies for the consideration of peace the activities for the prosecution of the war are proceeding unabated. The feeling, however, is undoubtedly manifest that the beginning of the end is in sight, and while it is not anticipated that present activities will immediately cease, it is not unlikely that the near future may see some easing up in the operations of some enterprises that are now working to capacity.

Steel For Work Exclusive

On a par with the manufacture of munitions is the imperative need of boats for transportation to offset the continual destruction by the submarine. During the past few months the importance of shipbuilding has been impressed vividly on the minds of the Allied Governments and every facility has been given to the increased production of plates for this industry. The consequence has been that further restrictions have been placed on the distribution of plates, and in some instances large locomotive firms have experienced increased difficulty in getting their accustomed allotment for boiler construction. Another instance that demonstrates the priority shown to shipbuilding is the increased difficulty that makers of large pipe have in obtaining supplies for their mills, as the mills working on this material is largely utilized in turning out ship plates.

Some theorizing is taking place as to the possible developments in the steel trade should active warfare terminate in the near future. Some speculation is made regarding the non-essential demand for steel at the present time and which the mills are unable to take care of. While some think that a great part of the current production could be diverted to domestic requirements, it is a question whether this demand will be as apparent as it is now. The mills that are now working on rounds for shell billets could undoubtedly meet every demand for this class of steel, but in the matter of plates and shapes the solution is more difficult. The present program for ship construction will not likely be reduced and transportation needs will almost equal that of the war period, so little relief can be expected in this direction. The period immediately following any serious peace considerations will probably result in a slightly easier situation as to structural material, but the imperative need for this class of steel will return when the reconstruction period is well under way. The news of the past few days has given an uncertain air to the general situation and few will commit themselves as to possible developments.

No Relief In Tool Situation

Machine tool activity at the present time is virtually confined to the production of equipment for the manufacture of war supplies. The question of prompt delivery is seldom mentioned in negotiations, as the heavy demand for machinery makes it impossible to obtain definite assurance as to shipment. Where tools are brought into Canada from points in the States this condition is particularly emphasized, owing to the heavy placement of Government contracts. In few instances will delivery be promised under six months and even then no guarantee is given. The uncertainty of the situation places the manufacturer in a position where a heavy overhead is necessary and production is far below the possible maximum.

Local plants, working on the larger American shells, are getting fair delivery on needed equipment, but not sufficient to meet all requirements.

Scrap Reaction Not Unlikely

Conditions in the old material situation are developing to the point when a downward tendency may be expected. With the bulk of the scrap business under the indirect control of the Imperial Munitions Board, the dealers are placed in a position more or less dependent on the wishes of the body. During the past summer small junk dealers have been very active in scouring the country for every description of old material that could be utilized as scrap, with the result that the yards of large dealers are well stocked with every variety of old metal material. Much of this has been disposed of at different intervals, but the inter-operation of munition manufacturers has eliminated a large portion of the business formerly carried on by the individual dealers. Considerable machinery is apparently accumulating, much of this being "cast-offs" from shell making plants. The scarcity becoming less pronounced and dealers are looking forward to lower prices.

The latest news has added to this belief, and as one dealer stated: "With peace talk abroad this kind of scrap will soon be a drug on the market."

PEACE TALK HAS NOT AFFECTED TRADE

Big Volume of Business in Sight—Supplies Sought for Manufacture of 155 MM. Shell

TORONTO — Dealers in machine tools, as well as firms engaged in making them are watching events in the war zone with considerable interest just now. Officials of the Canadian War Trade Board are in Washington this week. The mission they are apparently on has much to do with the future of the machine tool business in regard to munition plants. The peace move that has apparently shown its first signs of coming to life may have a decided influence on the situation. So far there is nothing to indicate that there is going to be any falling off in the business of making shells and munitions of war.

In fact there has been nothing to indicate that the first signs of peace—when they do show up in earnest—are going to have the effect of unsettling the situation to any extent. Dealers report that there is still a very keen demand for all sorts of equipment, and there have been no cancellations.

POINTS IN WEEK'S MARKETING NOTES

In order to conserve the supply of iron on hand in the yards of the makers of sewing machines, some firms are thinking of bringing out machines with wooden legs.

—

Peace talk has not interfered with the demand for machinery for the purpose of carrying out war contracts. The demand for equipment and supplies in connection with 155 mm. contracts is brisk.

—

There is a scarcity of light sheets in Toronto just now. Some of the dealers have nothing in their yards. This stock is used largely by the makers of stoves, builders of smoke stacks, etc.

—

Scrap metal dealers are not anxious to buy too heavily because users of scrap in many cases are having such difficulty in securing pig iron that they may have to greatly curtail or suspend their operations.

—

Tin plate mills have been operating at seventy per cent. capacity for some time, but the chances are that now that the canning season for perishable fruit is over this figure will be decreased severely.

—

American foundries are not making much progress yet with the manufacture of semi-steel shells.

—

It is estimated that Detroit has had since the beginning of the war at least $900,000,000 in war orders.

—

The big automobile industry in Detroit is working 75 per cent. on government war contracts now.

—

A slight reaction is noticed in the price of some of the war securities on the market, while those that will be in good shape for after-war trade remain strong favorites.

The Market is Firm

Light sheets are on the way up. They have passed the lowly 10 cents per pound mark, in fact some of the warehouses that are quoting this mark have none in stock, so they might as well quote five cents as ten. The houses that have light sheets are selling them out in nearly every case around 12½ cents, and there is nothing to show that the top has been reached in the matter of prices. The industries that are most affected are the stove makers, and the firms using much material for roofing. In fact there are a multitude of purposes to which sheets are put, and they are all more or less being put on thin edge by the scarcity and price of sheets. For a long time No. 10 gauge (140) was used almost entirely for the building of smoke stacks, etc., but for this purpose No. 11 can be used, which is ⅛ of an inch in thickness. No. 10 used to be about one half of the tonnage for stacks, tanks, boilers, etc., but it is hardly imported at all for this purpose now.

Firms entering the market for steel supplies are still finding that the going is poor. This week a large concern in the east applied to the War Trade Board for supplies for the finishing of a plant where chemicals were to be manufactured, but the Ottawa authorities seemed to have it figured out that it would be some time before they could produce any of the finished article. Their application for material on the embargo list was refused.

In a Queer Place

The scrap metal trade moves slow this week. Occasionally there are disputes over the prices quoted in this paper. Some dealers state that there is too great a spread between the prices quoted here and at Montreal. Montreal is a consuming point. The same can hardly be claimed for Toronto. The prices quoted for Toronto are net tons, and for Montreal gross tons. For instance, boiler plate is quoted $27 in Montreal against $20 in Toronto. The difference between a gross and a net ton is at the Toronto price, $2.40, which brings the Toronto price to $22.40 at once. Add freight of $4.48 and the price comes to $26.88, which is not far from the Montreal figure of $27. The figures quoted in the scrap trade are corrected each week, and are the prices that the dealers here will pay for scrap.

Some dealers that have quite a quantity of scrap for the market at times claim that bidding is keen for anything they have to offer. On the other hand the yards state that there is nothing that would encourage them to go ahead and stock up now, although they claim there is the material to enable them to do this. They claim that there are some users of scrap metal, in fact quite a number, including stove manufacturers, etc., who cannot get a supply of pig iron to mix with their scrap. They see that there may come a time when they will be out of the market for scrap because they can get no pig, and for this reason the dealers are not anxious to buy very heavily now. There has been no change in the prices.

Prices on non-ferrous metals show no change at all. There is a good volume of business offering and prices are firm.

Brisk Machine Demand

There is a good demand for machinery now. Peace talk has not made any impression or depression on the volume that is offering and being handled. The manufacture of the 155 mm. shell is taking a lot of attention and is causing a lot of inquiries for supplies to come to the dealers here. According to information from Ottawa there is to be a revival on a fairly large scale of orders placed here for the British government, as well as for the United States authorities. For various reasons it is not good to mention definite figures, but very reliable estimates place the mark at a good many million dollars per month.

U. S. WAR PROGRAMME GOING TO COME UP TO MAXIMUM FIGURE

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Oct. 10—Production of pig iron and steel has been increasing steadily since summer weather disappeared. The rate of pig iron production, which hovered between 40,000,000 and 41,000,000 tons a year from April to August inclusive, is believed to have crossed 41,000,000 tons, and may have crossed 42 000,000 tons. Production of steel ingots has gained in whatever proportion has obtained with pig iron, as steel production has been hingeing upon pig iron supply for many months past. Improvement in pig iron production is attributed to better weather conditions, with less atmospheric humidity, and to better quality coke being furnished, this latter development being due to the continued and strenuous efforts of the Fuel Administration. There has been little shortage of coke from a tonnage standpoint for several months past.

The official statistics of pig iron production in the first half of 1918 have just appeared, but give little news as to the total since that had been estimated very closely. The half-year's production was very poor. Output in the first quarter was far and away below the output in any quarter for several years by reason of the traffic blockade, which caused a coke shortage. Output in the second quarter probably made a new record for a quarter, but it was nevertheless quite below the rate capacity of the furnaces. Production as officially reported, in tons of 2,240 lbs., has been as follows:

	Tons
First half of 1916	19,619,522
Second half 1916	19,815,275
First half 1917	19,258,235
Second half 1917	19,362,981
First half 1918	18,227,730

From the first half of 1917 to the first half of 1918 there was a decrease in total output of more than a million tons. Production of basic iron was stationary. Foundry and ferro- silicon showed a slight decrease but this was a trifle more than made up by an increase in malleable iron, so that the net result was that the million ton loss in total output fell entirely on Bessemer pig iron. The showing is a remarkable one, for the foundries were not supposed to be particularly busy in the first half of this year, while steel making iron, both basic and Bessemer, was badly needed, and it does not look as if the blast furnace capacity was used to the best advantage.

Of late the authorities have been making a special effort to curtail the production and use of foundry iron in order to provide more iron for steel making. About a month ago a committee was appointed to seek cases of unnecessary consumption of foundry iron, the object being to shut off the consumption and either supply the foundry iron for making semi-steel shells or discontinue its manufacture in favor of one of the steel making grades.

The Eight-Hour Basic Day

It is well established that, since the Steel Corporation announced adoption of the basic eight-hour day, its adoption will be general in the iron and steel industry. The movement is going farther, however, for the Employers' Association of Pittsburgh, composed largely of foundry and machine shops, has decided to do likewise. In their case the increased wage cost will be relatively small as they do not have a great deal of time beyond eight hours. This association makes the proviso, however, that payment of time and a half shall be on the basis of 48 hours a week straight time, not on the basis of considering each day by itself.

The iron and steel industry has been working out details of application. There will be no double time, and as to regular Sunday work, it is probable that there will be time and a half for the first eight hours. There is much Sunday work that is of regular character, as in the operation of blast furnaces and by-product coke ovens, the men as a rule being given one day off out of the seven. Many men prefer that day to be a week-day rather than Sunday, and in such cases there is no occasion for a bonus for Sunday labor.

Steel Supply Short as Ever

While the War Industries Board has not yet completed its revision of the estimated total steel requirements for the half year, stated early in July at 20,000,000 net tons and later increased to 23,000,000 tons for certain and 25,000,000 tons as a distinct possibility, it now hints that the total will not be reduced. As reported in previous letters, there has been a strong effort to cut down all estimates wherever possible, even shell steel and ship steel being scrutinized to see if they were being furnished in larger tonnages than were being consumed. The intimation that the estimated total is not likely to be reduced does not mean, however, that there has been no opportunity found for curtailing in any direction. Rather it means that new wants have appeared that offset any reductions that may be compassed. For this, General Pershing seems to be chiefly responsible, his demands increasing right along. Probably there are also increased demands from Britain and France. Then the Railroad Administration has been calling for more steel, wanting more rails than the 40,000 tons weekly that have been furnished, and being desirous of placing orders for more cars in addition to the 100,000 ordered a few months ago, and which it is desired to get out of the way before the end of the year.

The Conservation Division of the War Industries Board continues to make agreements with various manufacturers who use more or less steel, with a view to limiting their operations. While these curtailments appear rather impressive, from the viewpoint of the commercial wares that will be cut off from the civilian population, they are not equally impressive from the viewpoint of the tonnage of steel they consume. It does not mean a great deal in point of steel tonnage, and it means much more in point of labor that will be saved in such factories.

Very little definite progress seems to have been made in the matter of arranging for quantity production of semi-steel shells. Foundries do not find that the technics of manufacture have been advanced to such a stage that the work can be undertaken with confidence.

Tin plate production is destined to fall rapidly. The order of a month ago that production be limited in the fourth quarter of 1918 to 70 per cent. of the production in the same quarter of 1917 is in force, but the limitations as to tin plate consumption are so great that nothing like the 70 per cent. could be made. By a general rule tin plate, apart from that bought by the government, can be used only for packing food products, this rule applying equally to the United States, Canada and South America. The perishable foods, however, are about done, and the Food Administration has been making arrangements with packers of non-perishable foods whereby their consumption will be greatly reduced, and the visible market is thus brought far below the 70 per cent. limitation.

BIG AUTO CONCERNS TURN TO WAR WORK

Estimated That Detroit Has Had About $900,000,000 in War Contracts

Special to CANADIAN MACHINERY

NEW YORK, October 10.—Steel companies, shipbuilders, manufacturers of guns, shells, aircraft motors and motor trucks, as well as the Ordnance Department of the army, have purchased machinery in the last week and numerous other contracts are pending. The greatest activity has been in the Central West, especially at Cleveland, Detroit, and Chicago. Most of the buying by interior manufacturers was at these points, but it is notable that New England tool makers received a number of orders from the Central West.

Government inquiries for war material calling for an expenditure of $50,000,000 are reported at Detroit, and as the work is largely for foundries, it is presumed that the prospective orders relate to semi-steel shells. It is estimated that government contracts thus far placed in Detroit alone call for the expenditure of $900,000,000, more than half of such contracts will be fulfilled by the end of the current year.

Turning to War Work

Automobile manufacturers have turned to war work with renewed vigor, and most of the large motor car companies are now operating 75 per cent. to 100 per cent. on war contracts. The Maxwell Motor Co., the Studebaker Corp., the Cadillac Motor Co., the Paige-Detroit Motor Car Co., the Liberty Motor Co., Dodge Bros., and 120 companies making motor car accessories are now operating 75 per cent. on government orders, while the Ford Co., the Packard Car Co., and the Hudson Motor Car Co. have their full capacity engaged on war work.

The Winton Co., Cleveland, which is manufacturing tripods for the large type of Browning machine guns, has purchased machine tools in the last week and is still in the market. With the installation of this machinery the entire capacity of the Winton Co. will be engaged on government contracts. The Doehler Die Castings Co., which is making parts of airplanes, is buying machinery for its Toledo, Ohio, plant. The Willys-Overland Co., Toledo, has purchased some tools and is negotiating for others which will call for an expenditure of $300,000 and which will be used in manufacturing 12-cylinder airplane motors. The machinery being purchased includes boring mills, lathes and milling and drilling machines. The government is now taking bids from Cleveland manufacturers on recoil cases for Davis guns for the navy, and the manufacturers in turn are inquiring for the necessary machinery.

It is estimated that between 300,000 and 400,000 tons of steel will be needed for the manufacture of motor trucks, the contracts for which were recently distributed by the government. Orders are now pending for 40,000 rear axles for type B army trucks, and with the placing of these orders additional machinery will be purchased. The American Can Co, which has large government orders for munitions, has purchased twenty screw machines for installation at its Toledo plant.

Canadian Business

The United States government has placed additional contracts for shells with Canadian manufacturers and an active demand for tools has resulted. It is reported here that most Dominion manufacturers are so filled with work that they are unable to accept orders for shell machinery. The Canadian shipbuilding industry is also expected to spend several million dollars for equipment and it is possible that some of these orders will come to the United States.

The Charlestown Navy Yard, which is about to make extensions, will require considerable machinery. The Newport News Shipbuilding & Drydock Co. has placed an order for cranes with a Cleveland manufacturer for its new boiler shop at Richmond, Va.; this buying is supplementary to the orders placed several weeks ago. The Ameriacn International Shipbuilding Corp. has purchased four cranes for the Hog Island plant. Crane inquiries have also been put out by the Wm. Cramp & Sons' Shipbuilding & Engine Building Co., Philadelphia., and by the Liberty Steel Products Co., New York.

The Ordnance Department of the army has placed contracts for large gun boring and turning lathes for the Nevilie Island ordnance plant and for the gun relining plant in France. It was found necessary to place these orders with manufacturers that previously had not made such tools but who have facilities for such work.

GOOD HOMES FOR EMPLOYEES OF BRANTFORD STEEL PRODUCTS

The plans of the Dominion Steel Products Co., Brantford, having in view the erection of a model village to be available for its mechanics seeking residence, are fast approaching realization. In Lansdowne Park a very desirable section, not far from the company's plant, quite a number of houses are in course of erection—several in fact approaching completion. The houses are in every sense substantial. They are of concrete foundation and built of hollow tile covered with stucco. The idea uppermost in many undertakings of this kind, when industrial concerns have sought to solve the housing problem—when the houses are much of the same type, with little thought of permanency, comfort, or attractiveness to the home builder—is here conspicuous by its absence.

The company plans the erection of one hundred houses, and these will be divided into seven separate and distinct types. The tract of ground for the purpose is sufficiently large to permit of these types being so arranged as to overcome any danger of monotonous similarity in the general plan. The lots have an average depth of about 150 feet and there will be no frontage of less than forty feet. Each house will cost about $4,000 to build. Each is a separate 7-roomed dwelling—that is there are no so-called terraces or semi-detached structures. It will be a section of which Brantford, or any other city, large or small, may well be proud, and one in which the better class of mechanic will find a home amid exceptionally inviting environments. The dwellings will be made available to the company's employees at cost.

The Dominion Steel Products Co. are at present engaged entirely on war work. After the war this huge plant will be organized as a permanent industrial concern.

PRODUCERS OF PIG IRON NOT ABLE TO KEEP UP WITH ORDERS

THERE is considerable speculation in regard to the pig iron market in the United States at the present moment. When the government authorities allowed an increase of $1 per ton on pig iron recently they also made the stipulation that future deliveries would be covered by that price no matter when the orders had been booked. A lot of firms have orders that have been standing for weeks and months at the furnaces, and now if they are anxious to secure deliveries at once they will have to come along and pay the additional cost. If they are not willing to do this why the furnaces can refuse their business. Reports from some of the larger points in the United States are as follows:

Pittsburgh.—It is believed that September production will make the best showing for several months, and as many furnaces which have been down for repairs or for relining, will go into blast within the next few weeks; it is thought likely that the present month will make a record.

Buffalo.—The increase that has been granted on pig iron does not seem to satisfy the furnace men in this district. They point out that the increase in the price of ore of 25 per cent. per ton will take 50c of the $1 increase per ton of iron and that the rest of the $1 will be taken up by increased labor costs. One thing that has been keeping back production as much as anything else has been the very inferior quality of the coke that has been sent to the furnaces here for some time past. There has been an improvement in this lately since a drastic action has been taken by the government.

Cleveland.—Firms that have any pig iron in their possession are being welded up by the war authorities and are being made to pledge that this material will be used for war work and nothing else. A circular letter now being sent to the producers by the committee of Pig Iron. Iron Ore, and Transportation, calling upon the trade to secure these pledges from their customers.

St. Louis.—Deliveries here are excellent and the war plants are all working at capacity. Little comment is made on the increased price in iron here as the consumers are so anxious to get material that they are willing to pay anything within reason for it.

Chicago.—Some of the users of pig iron in this section are going behind in their deliveries all the time. This is accounted for by the fact that government allocations come along and make large inroads on the stock with which they had intended to fill the orders booked. In fact one of the largest makers here states that his plant right now is 150,000 tons behind their schedule on regular contracts. He also stated that it would take him at least two months to recover this ground. This same situation is quite common all over the district.

ENGINE BUILDING ON PACIFIC COAST

In a recent issue of this paper an article appeared entitled, "Vancouver Firms Pool Engine and Boiler Orders."

In the course of this article, Mr. McCulloch was quoted as stating with regard to the building of engines, that on the smaller types they could compete, but on the larger ones it would be difficult. In fact it had not been undertaken.

We are informed by Mr. A. F. Menzies, who is now in Ottawa representing the Wallace Shipyards, of Vancouver, that the construction of large marine engines and boilers has been undertaken and well carried out, and is proceeding very successfully. The following list of engines already built and in course of construction by this company remove any doubt on the matter:

S.S.War Dog, 1,350 I.H.P., now at sea.

S.S. War Power, 1,650 I.H.P., now at sea.

S.S. War Storm, 1,650 I.H.P., under construction.

S.S. War Cayuse, 1,000 I.H.P., now at sea.

S S. War Atlas, 1,000 I H.P., ready for trial trip.

One steamer, 1,000 I.H.P , under construction.

Vessel No. 100, 1,800 I.H.P., under construction.

Vessel No. 106, 1,800 I.H.P., under construction.

Two engines of 2,500 I.H.P.,, plans in hand.

The next size to be undertaken will be of 3.000 I.H.P.

The boilers for the above vessels are being constructed at the Vulcan Iron Works, Vancouver, and this firm are also building boilers for the vessels under construction at the yard of the J. J. Coughlan & Sons, whose boiler shop was recently destroyed by fire.

The foundry of the Wallace Shipyards Ltd. has furnished all the iron and brass castings for the above vessels, excepting the first two. The foundry has also turned out a number of propellers for the Imperial Munitions Board, and one large manganese bronze propeller for a coast steamer. From the foregoing it will be seen that engine and boiler building on the west coast is an accomplished fact, and we are pleased to correct the impression given by our previous article.

MANY ACTIVITIES GOING ON IN THE ST. JOHN DISTRICT NOW

Work is being pushed on the new wooden steamer, "War Digby" in the Grant & Horne yard, Courtenay Bay.

In the Marine Construction Company's yard, Strait Shore, Mr. D. H. Saker has a large four-masted schooner framed up. The work is progressing rapidly.

The C.P.R. has extended its grain conveyor on the west side in anticipation of an enlarged traffic during the coming winter.

The Eastern S. S. Corporation has renewed its lease of the city wharves at Reed's Point. The landing pier has recently been placed in thorough repair.

The government wharf below the Atlantic Sugar Refinery, destroyed in a recent gale, has been restored.

Repairs have been made to the government railway track at Courtenay Bay

The pier on the north of the West Side ferry slip has recently been rebuilt by S. H. Mayes, contractor for the city.

The Imperial Oil Company are hastening the completion of their three-storey brick warehouse at Barrack Point. The new building will have a very comfortable office equipment.

The Booth Sardine Fisheries have added a large boiler room to their building plant. This corporation is now well equipped for sardine packing.

The replacement of St. David's Presbyterian Church destroyed by fire in December last has been begun. The new structure will be a creditable one. It is the intention to place the school building in the rear instead of in the basement as before.

The Roman Catholic school building on Cliff street is almost complete, and in the fall will be occupied by schools. This building is one of the handsomest and best equipped of the school buildings of the city.

Golding and Starret, Ltd., with a capital stock of $5,000 and head offices at Petersville, Queens County, has been incorporated for a lumber and pulp business.

The Bealgrave Mines and Development Co., Ltd., with a capital stock of $78,000 has been incorporated for the purpose of carrying on a coal business in Queens county.

The Kay Engine Company has been incorporated at St. Andrews to promote the construction and sale of the Kay engine.

A movement is on foot to accelerate the development of the coal mines in Kent county.

FREIGHT ON MATERIAL FOR BOAT IS $80,000

High Figures That Ship Yards of the Pacific Coast Have To Work Against

A. F. Menzies, of Vancouver, representing the Wallace Shipyards, Ltd., of North Vancouver, has been in the east for a few days, having been called to Ottawa in connection with new contracts for vessels under the order of the Dominion Government. The Wallace yards have practically completed the work they had under way for the Imperial Munitions Board, but they have preparations well under way for going ahead with their other construction work. The Wallace yard had a launching on Saturday last, which was most successful. The "War Storm" being put into the water. This was a steel vessel of some 4,700 tons. The engines were h.p. 25, i.p.41, l.p. 67. and 45 stroke, developing about 1,650 horse power. The ship yards with which Mr. Menzies is connected are gradually working into the construction of ships of larger size, and berths are now prepared to take care of construction up to 8,100 tons.

As a general thing the coast yards do not build the machinery for the boats they make, but at the Wallace yards this is all done. They have had very good success in their foundry and all through, having cast about 17 cylinders without losing one. Very little difficulty is experienced in securing all the raw material that is necessary for the foundry or machine shop work. The boilers used are the output of the Vulcan Iron Works, at Vancouver.

To a question as to whether it paid to build the machinery at the coast, Mr. Menzies replied "we build the engines because we cannot buy them. Of course, the freight charges work against us there, and they run into a lot of money on a steel vessel, when all the plate is hauled to the Pacific coast from the rolling mills of the United States. On some of the ships we have made the freight on the material will run from $75.000 to $80,000."

Mr. Menzies has spent some time at Ottawa in consultation with the officials of the Marine Department, going over details in connection with some of the new orders the Wallace yards are taking on for the Dominion Government.

McAvity Plant Growing.—The McAvity machine plant, Marsh road, St. John, N.B., is rapidly developing into one of the largest enterprises of the kind in eastern Canada. The 400-foot unit, which was completed in such record time in 1916, has recently had a unit of similar dimensions added to it and this is being quickly filled up with machinery. But even with this enlargement the firm are not satisfied, for within a few weeks the erection of another large foundry building has been begun on the southern end of the company's lot near Westmorland road. Grant & Horne, who constructed the original unit have the contract for the later additions.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	100 00	95 00
Spelter	10 75	11 00
Lead	10 50	10 00
Antimony	16 00	18 00
Aluminum	50 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 37

Standard Buttweld

Per 100 feet	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	30 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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..	$ 8 00	$ 8 25
Sheets, black, No. 10..	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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...	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck..	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod..	0 38
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra..	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

Colored.

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

Wool Packing.

Arrow	25	Anvil	16
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	.36 to .40
Tin	.70 to .70
Zinc	.23 to .25

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium carbonate	.33
Ammonium, chloride	.40
Ammonium hydrosulphuret	.40
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.75
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.15
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.50
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.16
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

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AND MANUFACTURING NEWS

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CANADIAN MACHINERY
AND
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October 17, 1918. Volume XX. No. 16.

Making of Files Used to Be All Hand Work

Interesting Features of an Important Piece of Work—Just Now the Securing of Material and the Making of Files is Proceeding Under Cramped Circumstances

By DONALD A. HAMPSON, Assoc. Mem. Am. Soc. M. E.

The first of this article appeared in the issue of CANADIAN MACHINERY of October 10

CUTTING

FILE teeth are cut in machines which drive a chisel into the blanks with great rapidity, moving the bed on which the files lie at a rate according to the "pitch" of the teeth—in file parlance, according to the "cut." Some files are cut by hand but the number is negligible, and it is predicted that the practice will die out with the present generation of file cutters. There are two general types of files cutting machines in use: the Weed, an English machine, and the Hess. The latter is more complicated but does the very nicest kind of work and is fast—it is not so well adapted to the larger files such as a machinist uses in his daily work because of structural weaknesses inseparable from the design.

The two photographs show Weed machines of different sizes—the first has a "hammer" of but 2 pounds weight, while the larger one has a 40 pound hammer. The hammer carries at its lower end a chuck, B in Fig. 4, in which the chisel is fastened; the weight of the falling hammer together with the reaction of a compressed spring drives the chisel into the file. At the back of the machine in Fig. 13 will be seen a pulley; this drives the main shaft which has at its inner end a two or three-lobed cam that raises the hammer and compresses the spring that many times for every revolution and allows the drop between every raise.

In Fig. 14 is shown the details of that part of a file cutting machine that in machine shop practice would be termed the carriage and carriage feed. The solid black represents two flat file blanks laid on the swivel bed C that can rock in the slide G but is confined longitudinally by shoulders which may be seen in Fig. 13. Should the files be slightly uneven in section or the chisel not ground squarely across on the bottom, this swivel bed instantly adjusts itself under the blow and the cut produced is of the same depth at each edge of the files. The slide G is an accurately finished casting fitting the planed V in the base of the machine. The base of the machine is solid and the blow is delivered right over the center; with this base set on a foundation of cast iron and concrete there is formed the finest kind of an anvil for hammer blows—the parts G and C are of a form that is self compensating for wear and that rigidly builds up the anvil to the working level.

FIG. 13. MODERN FILE CUTTER

The cut is started at the point of a file and runs toward the heel—this means that the working parts travel away from the operator, the travel being by power. Figs. 13 and 14 show this mechanism. A cross shaft at the rear of the machine is belt-driven from the main shaft. Bevel gears deliver the power to the buttress thread screw at the side of the machine which moves the slide when the half nut F is engaged. To start the feed (and the cut on a file), the operator presses the nut against the screw; to stop the feed two methods are employed; one is to use a trip which disengages the nut quickly, and the other is to shift the main driving belt to the idle pulley on the back of the machine, which is the method used on the machine in Fig. 13, where part of the throw-off may be seen below the pulley. On the smaller machines the workman shifts the belt by a hand fork at the end of the cut. The slide is returned to the starting position by raising the nut and pulling back by hand.

To make the return easier the V cut in the bases of the larger machines is at an angle of about 15° with the horizontal. Lubrication of these V's, some of which are as big as on a 48 in. planer, is by oil channels and a squirt can just as with a planer. The pounding that the beds get sets the moving parts pretty close together and tends to break down the oil film, and the workmen show signs of fatigue after pulling back on them for several hours. It was found that by putting a wedge-shaped piece in the clearance space in D and allowing the slide to ride on this at the end of the stroke, the slide was raised enough to break the grip of the suction created and the parts traveled much more easily.

Belt drive has been found most satisfactory for file cutting. There is enough flexibility in it to take care of the momentary stoppage of the bed every time the chisel cuts into a blank. To cut coarser or finer teeth on the same machine the pulley on the cross shaft is changed and the belt length altered to suit—some of the commercial forms of V-belt lending themselves to such changes very nicely. Another and better arrangement for changes is to use an idle pulley with a swinging arm that may be set to take up the slack without altering the belt length. In larger shops and where possible, a machine is kept set up for one cut of file and kept so. In this connection it must be noted that the pitch of the teeth for each so-called cut varies with the size of the file—thus a 14 in. bastard file will have coarser teeth than an 8 in. bastard file.

The feed screw and nut are important parts of the machine and do quite heavy work. Ball thrust bearings are now used on the screw to relieve the shoulder of the pull of the cut and are very satisfactory. A babbitt nut is used for cheapness of renewal and to take the wear from the screw itself. Fig. 16 shows a portion of the screw and of the method of babbitting the nut. It is obvious to a mechanic that the nut can best be babbitted right on the machine if perfect alignment would result; it is also obvious that, being a top half, the nut is a hard one to pour. One shop settled the question by making a mold for each cutting machine. This mold, as seen by Fig. 16, is a lower half nut which completely fills the threads up to a horizontal center line; it also has heads at the ends making pasteboard and putty unnecessary. Placing the mold against the under side of the screw the nut is brought down on it and the two joined by a C clamp. Then all that is needed is a ladle of babbitt. The pouring holes at the top and the retaining heads of the nut casting hold the babbitt securely in place.

Due to the changing cross section, files do not lie well on the bed of the machine and some sort of a seat has to be built up for them so that they are solid under the chisel blow. Babbitt and zinc are the materials used for the purpose. At one time babbitt was freely used and the beds were made hollow on top and filled up to a working surface but increasing attention to small economies and the rising cost of babbitt have cut down its use three-fourths. Present practice makes use of the cast iron bed, shaped on top to the type of file being cut and overlaid with a strip of zinc. Thus a half round depression is formed for the back of half rounds, a V cut is made for three square files and a small half round groove for round files—in these cuts the zinc strip, 1-16 in. to ⅛ in. thick, is pened and then fastened with a screw or clamp. As these are worn out they are renewed and the old ones salvaged at the scrap price. Square and rectangular shaped files are laid directly on the bed with the strip of zinc under them; to allow for working variations this strip is cut perhaps a quarter inch wider than the file, and if this excess is good when the center is worn out, it is trimmed off and used under the edges of blanks which are having the teeth cut on the edge.

Fig. 17 shows a round file and how a bed of babbitt would be arranged under it. Fig. 18 shows a babbitt bed under a file set for edging. The better way with both the foregoing would have been the solid cast iron with zinc facing. Cast iron itself would answer every purpose

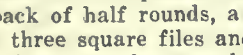


FIG. 19—A SPECIAL FILE

for the first cut but the facing puts the wear on a renewable piece. And after the teeth have been cut on one side it is policy to use every means to protect them.

On the bed of the file cutter there is screwed near the operating end a piece of steel with a taper notch corresponding to the tang of the file. This acts as a vise for the tang end during cutting. The point end, and in fact the entire file is kept from rebounding by a "pressure foot" which acts directly in front of the line of cut. How this works is shown in the details of Fig. 15 which shows also the first tooth cut. This pressure foot is connected to a slide controlled by the lever shown at the left

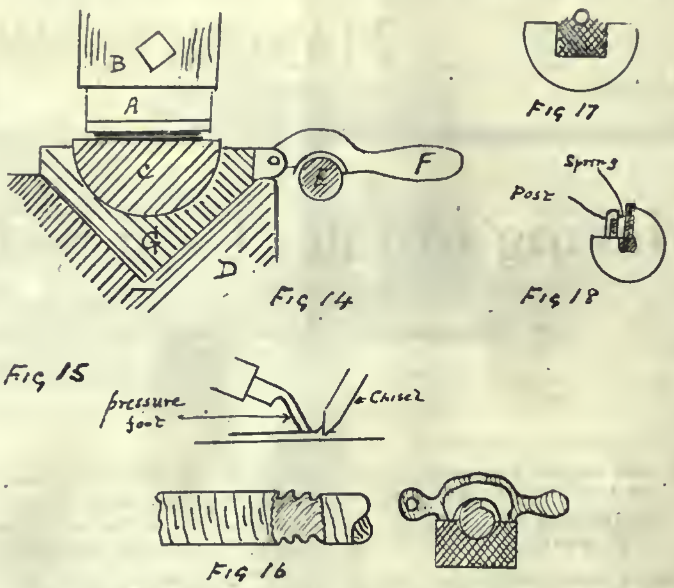


FIG. 14—DETAILS OF PARTS. FIG. 15—HOLDING DOWN THE BLANK. FIG. 16—SCREW AND METHOD OF BABBITTING. FIG. 17—ROUND FILE ON BED. FIG. 18—HOLDING TO CUT EDGES.

in Fig. 13, which lever is weighted to give the desired pressure for the size of file at hand. By means of a foot treadle the slide is raised for removing the file.

The actual cutting of even the largest files takes but a few seconds for each side. A skilled cutter handles the files very rapidly, turning them after one side is cut and doing the second or third side before piling on his bench. Though most machines will be found cutting one file at a time, on production work two and three are now the order of the day. Fig. 14 shows two flat files side by side, covered by a wide chisel. When cutting the flat side of half rounds, the swiveling possibilities of the back are taken advantage of and three are set in a three-grooved bed with a sufficiently wide chisel to cut out all at once.

Because of the increasing thickness toward the heel the blow of the hammer has to be regulated so as to cut a constant depth of tooth. It is for this purpose that the hand wheels are put at the top of the machines. These wheels are sometimes dished to bring them to a convenient working position—the operator keeps a hand on the wheel all the while, and, with a skill that is cunning moves it to produce the perfect file. The hand wheel turns a screw that compresses the heavy coil spring and produces a deeper cut. A cylindrical block of rubber is used instead of a spring on smaller work.

Round files require a dozen or more cuts. So cut, their surface is really a succession of flats. It is these numerous cuts that add to the cost of rounds. This cost has been reduced somewhat in shops that have standardized their shapes by using less skilled labor and, by means of limit stops for travel and a form which automatically changes the blow instead of doing it by hand, getting the same quality of work as before.

Etching is a method sometimes used for round files of the better grade. Still another method which produces a superior file is to cut a spiral like a thread the entire length, doing it with the same chisel-driving mechanism—this cut in distinction from the other, whose cuts meet but approximately. The spiral cutting is done by a device which bears a resemblance to universal milling machine fixtures for cutting spirals, i.e., turning the file while the bed is advancing at a predetermined rate. The file so produced is commercially round and can be used for the best class of work.

On the broad side of flat files the cut needs to be varied but little because the total difference in thickness is only about 1-64 in. to each side, but when it comes to rounds and tapers and the edges of flat shaped files, the difference may be as much as ¼ in., and much variation of the blow is required to produce an even cut throughout the length. It is here that the eye of the cutter must work synchronously with the hand, or with her hand, for women have been taking the place of men in file work for the last few years and have done very well.

When cutting the teeth on the edges the files are supported as shown in Fig. 18 by resting against a vertical side cast on the bed and having a light flat spring set in the post as shown, pressing the blank up to the side. Sometimes there is no retaining piece used, and again a strip is screwed to the horizontal face forming a shallow groove in which the files are dropped. Two and three files are cut on edge at a time on the less particular grades.

There are hundreds of cutting machines in some of the larger plants and every machine uses one chisel when it is running, besides which the cutter usually has several other chisels allotted him for different cuts. With so many of these tools the necessity of some system of grinding them is evident; if every man left his machine idle and went to a distant grinder for sharpening even once a day the loss would be considerable to say nothing of the loss resulting from every man grinding according to his particular ideas. The most satisfactory way is to have a tool boy collect the dull chisels twice a day, taking them to the tool room where they are ground on a tool grinder which is arranged with set fixtures to make every chisel of the same class alike on the cutting edge. A sharp chisel is given in return for a dull one and each man gets his chisels on check just as machinists get tools from tool rooms by check. The amount of money tied up in a few thousand chisels of expensive steel is worth the effort to keep track of them.

Cutting is a piecework job as are many of the other operations on the file. The cutter gets paid say twelve cents a dozen for 10 in. mill files. The blanks are given out to the workman maybe thirty or forty dozen at a time from a distributing crib and he must return the same number when he is finished—if one or two or three are spoiled in cutting no deduction is made, but if a man habitually spoils a greater number he is charged with them. A defect in cutting that does no harm except as to appearance puts the file in the "second" class, and it is hardened separately, packed, and sold under another name. An odd feature of the piecework price is that the large file pays less than the small one, the coarse one less than the fine. The reason is clear when we consider that there are more teeth to the inch on the smaller files of the same cut and with all finer cuts it is necessary to keep the chisels in better shape and take more care to get uniform teeth—on an 18 in. bastard file for instance a slight variation in the teeth would escape the notice of all but the expert, and it would do no harm anyway.

Stripping

There is an operation preceding the cutting that must be mentioned. It is called "stripping." Machinists would call it "draw filing," for that is really what it is—the file blanks are draw filed after they come from the grinders by using regular files either in a machine or doing the work by hand. In the vernacular of the trade, stripping "opens the surface" of the file (which may be more or less rolled down by grinding) as well as smooths the file generally, levelling off possible high spots and removing burrs. The broad side of flat shapes and of half rounds are done in stripping machines where a number of blanks are laid side by side on a working table which is given a limited side movement at the same time that the overhead file is passing back and forth throughout the entire length. The sharp corners of square and flat shapes are draw filed to remove the keen edge and to take off the metal that, if left on, would create a projecting edge at each corner as the teeth were thrown up by the chisel working on the side and the edge both.

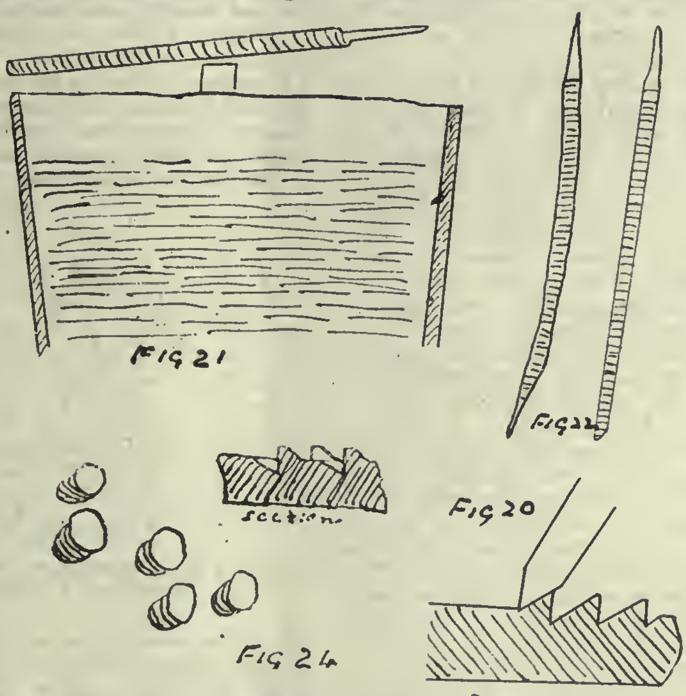


FIG. 20—HOW PRECEDING TOOTH GUIDES HAND CHISEL. FIG. 21—STRAIGHTENING APPARATUS. FIG. 22—BEFORE AND AFTER. FIG. 24—RASP TEETH.

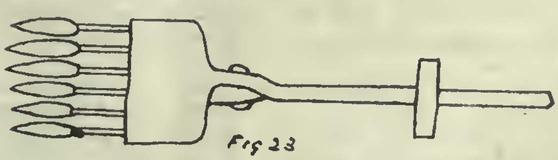
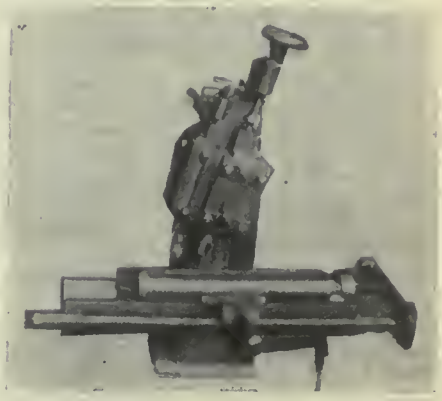


FIG. 23—TONGS TO HOLD SIX SMALL FILES.

Hand Cutting

Hand cutting is still practised to some extent, chiefly on specials. The long-



SMALL FILE CUTTER.

fancied advantage of hand cut files for regular machinists' use was in the irregularity of the tooth spacing. Theoretically they would cut faster and smoother because the teeth would therefore not create chatter marks; also not so many touching the work surface at a time, the file would take hold better and remove more metal. These supposed advantages have been pretty well discounted because it has been proven that a man quickly tires when he makes a "hand planer" of himself; try as he will he cannot remove metal as fast as a machine, because a file properly selected for the work will do smooth work, and if the dies are made of the right shape to give the files the taper and belly no trouble should be experienced in filing straight and in removing any reasonable amount of metal. Irregularly spaced teeth have been and still are made—a conventionalized hand cut, as it were—but for the reasons above stated such a file is not worth the extra trouble of manufacture and most manufacturers have discontinued making them. The name "increment cut" is applied to such files.

Fig. 19 shows a special file. This would be made hand cut because of the relatively small quantities needed and the peculiar shape which would necessitate special rigging up. It is much like the common toolmakers' files but is made double ended with teeth on the flat of one end and on the edge of the other, leaving a safe edge either way. An expert cutter would get about fifty cents a dozen for cutting these at before-the-war prices, and he would cut teeth that run forty to fifty in an inch of length, fine work for toolmakers even at production speeds!

The cutter is aided in his hand work by the sense of touch. In Fig. 20 is shown a file with a few teeth cut and the chisel ready for another tooth; it will be noticed that the edge of the chisel rests against the raised part of the tooth last cut. This accounts for the regularity on fine work. Many of the so-called

Swiss files are hand cut—a skilled man will cut a 2 in. (surface) file on both sides in thirty seconds. Even this rapid work, however, is bettered a hundred per cent. when the work can be done on a machine.

Marking

Aside from inspection and stamping on the name, the file is now ready for hardening. Some shops persist in stamping

FIG. 25

ing their name on with a hammer and a hand stamp simply because those in charge have never seen it done any other way. The time lost and the cost of quickly battered up stamps is a heavy loss. Marking machines of the Slate variety are slow for this kind of work unless power driven. Some form of punch or press is the quickest kind of marking machine. A No. 18 Bliss press is plenty heavy enough—and a second-hand one is good enough—for marking files; the hand stamp is fastened in the ram instead of a punch and the machine belted to run about 20 r.p.m., at this speed the foot treadle can be blocked "down" and the machine runs slow enough to enable any ordinary workman to feed the files one at a time without trouble.

A most excellent marking machine has been made from a discarded file cutter. The drawing, Fig. 26 shows one of these converted machines—it has all the desirable features for this purpose, i.e., the blow is not limited in its travel and thus the machine is not stressed if a too thick file is put in it, and a thin file would be marked just as any other (which would not be the case with the punch press), the bed on which the files are laid has a self-adjusting arrangement that makes it very desirable for both flat surfaces and taper—the latter encountered when the name is marked on the tang, and the machine can be instantly set to deliver a light or a heavy blow.

Too light a machine should not be selected for this use, but there are found at times in all plants medium-sized or heavy cutters that have become so worn that they do poor work, and it is thought advisable to replace them. If the adjusting screw will hold the compression of the spring as the cam raises the hammer, wear in the other parts of a Weed machine will not make a great deal of difference. The head is swung to an upright position, the slide should be screwed or blocked so it cannot shift, and a hardened anvil set in directly under the blow. Then strips to suit the tang or heel of the files—adjustable for different sizes—are fastened to the bed. The expense of overhauling the vital parts of an old machine is not great, and when so doing the overhanging base and the long bed can be shortened, which, with the removal of unused parts gives a neat appearing machine.

This form of marking machine is really a drop hammer procured at little expense. As to the necessary weight of the hammer, this can be computed from the total length of line in the stamped name and the penetration desired; a heavier hammer can be made and put in a light machine but the additional parts required for the stamp and holder often make up enough. To prevent undue wear and tear, a stop is provided as shown, tripped by the foot treadle that holds the hammer up except when tripped, the cam within meanwhile simply revolving. Depending on the size and kind, from four to six hundred files can be marked in an hour's time.

Hardening

The universal practice is to heat files in a lead pot for hardening. Files are hardened only, not drawn as the machinist knows the term; in reality there is a certain amount of letting down the temper, for the files are taken out of the quenching bath before they are cold. In bygone days egg coal was used to heat the lead, but this is now obsolete, fuel oil or gas having taken the place of coal, oil being the more generally used. The saving of space, of fuel, and of attendance with oil or gas, to say nothing of the closer regulation, allow no comparison to be made with coal.

The files before hardening are coated with some preparation to keep the lead from sticking in the teeth. Whiting and wood alcohol is one of the commonest preparations though, due to the present high cost of the latter, water is now used extensively for the mixture—the water dries a little slower. Helpers or boys dip the files in the mixture and stand them up to dry, standing them against heated racks. It is highly important for the safety of the hardeners that there be no trace of moisture on the files when dipped. One of the most efficient arrangements for this work is a conveyor using a wire mesh belt, power driven, with the loading position close to the coating tank and the delivery at the lead pot. During its travel the belt passes through a gas or steam heated oven that is kept at a predetermined heat for the assured drwing of the coating; the speed of travel is also variable if necessary. This arrangement delivers the maximum number of files and does it without taking up any storage space at either end, the speed of delivery being subject to change by the hardener if for any reason he is retarded in his work. Saving in handling and in danger of the files getting bruised will soon pay for such an improvement.

The files are suspended in the lead by driving them in handles that in turn are suspended from cross pieces over the pot. The hardener always has a sufficient number ahead to give all a chance to heat thoroughly and slowly. Under the best systems two men work in a team and harden in the neighborhood of 300 dozen medium-sized files in a day, one man doing the dipping and the other the straightening. The old fashioned way was for one man to do both these operations, and while he did them well and rapidly the production was far less, due to the extra movements he must make. Under present systems it is considered better to let a helper place the working handles on the files before the hardener gets them and to remove them when the straightener is through.

The lead is of course kept at a red heat. Its surface is covered with pulverized charcoal or other substance to keep it from oxidizing. In connection with the conveyor scheme detailed above a saving in fuel was discovered in the files being so warm as they were plunged—a file as warm as could be held in the hand would not chill the lead to the extent that one at atmospheric temperature would—the heat required to raise the file to a drying temperature was saved and utilized, making the process one of pre-heating as well as drying.

Salt water is used for quenching the heated files. It is a medium that has not yet been superseded. The brine is made very heavy; salt is addd to the water until it will absorb no more. This heavy quenching bath cools better than water alone because it does not fly away from the plunged file as does the lighter medium; it makes better contact with the file just as the liquid lead in the heating pot makes a far better contact than would the coals of a fire.

Files are subject to bending or warping in the cooling bath just as other articles of carbon steel and for the same reasons, though system and quantity production and supervision have eliminated to an extent many of the causes of warping against which the hardener of a few odd pieces must battle. The straightener has been mentioned and his duties are to correct the worst of the crookedness which occurs after due precautions have been taken in manufacture, delivering a file that is commercially straight.

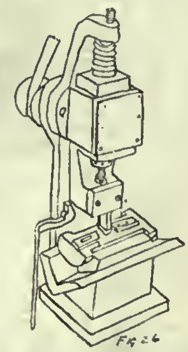


FIG. 26—A FILE CUTTER CONVERTED INTO A MARKING MACHINE.

To the machinist, the idea of straightening a piece which is glass hard and not drawn seems an impossibility. It is a trick of the file trade, and so well acquired that the straightener rarely breaks a file. While the file is yet warm, before it entirely ceases to sizzle, it is withdrawn and quickly inspected; if a crook shows up the file is bent the required amount and cooled in a way that will fix this shape permanently. For this purpose the workman uses a flat brush which he dips in his tank of water and applies to the side of the file that he wishes to contract. The usual method of bending is shown in Fig. 21; two bars are fastened across the top of the tank or near to it so that the file may be thrust between them and pried downward at the tang end, the concave side of the file having been turned uppermost.

Half round files are the most troublesome in hardening because of the unequal area of surface on the face and the back. To overcome this the hardener bends the file slightly as in Fig. 22 before he dips it in the brine, an amount which his experience tells him will be needed to counteract the "draw" of the greater cooling surface on the back. Another trick with half rounds is to plunge them in the brine, not straight down but with a circular motion that brings them out of the liquid at its end, the pocket of brine within the circle and above the file having less cooling effect than the body below the file.

Various improvements and kinks increase the production of the hardening department. Thus the smaller sizes, of which the special in Fig. 19 is typical, are held in groups for suspension in the lead and while being quenched. As shown by Fig. 23, special tongs with wide faces are employed that hold in this case six files at a time. A ring over the handles secures the files for the entire cycle and relieves the workman. The jaws are faced with rubber or cork or leather to provide the yielding necessay to holding the several pieces. Over 300 dozen of such files have been hardened both ends in a day by an expert.

A continuous hardening machine has recently been tried out in one plant and bids fair to be a distinct success. It is built on the station principle—loading station where the files are hung from arms so they are in the lead, a period of travel during which the file gets thoroughly heated, and an unloading station where the hardener takes the files off the arms with his tongs and dips them. The arms are driven by a central retaining spider rotating about a vertical axis. Each arm has a certain number of snaps which the loader opens to get the files in and which the hardener touches to release them. So fast does the hardener "turn 'em out" with this machine that two or three straighteners are kept busy on that final operation. Gang dipping on machinists and toolmakers' regular files is not attempetd. Every steel man knows the value of slow, thorough heating of an article to be hardened and the files in this machine get all of that. The files are grasped so they travel edge to the lead, so set and traveling at the slow speed they create almost no more disturbance of the molten lead than would an equal number of files simply submerged.

Going into the subject as a matter of research it has been found that files given a more extended heat treatment will do more work before wearing out than the files of manufacture. All of us are familiar with the qualities imparted to gears and other motor parts by successive heating and quenching and drawing, with the higher elastic limits resulting, the increase in wearing, and the wonderfully fine grain as shown by micro-photographs. Files are made from high carbon steel and to an extent partake of the qualities named when properly treated. These points were noted in connection with files when users reported that re-cut files gave better service than new ones—re-cut by softening, grinding off the old teeth, re-cutting and re-hardening. The refining of the second heat is now held responsible for this, a conclusion borne out by tests with new files that have been heated and dipped a second time and have then stood up much longer. The buying public however is not ready to pay the extra cost.

Clean and Pack

Following the hardening the files are cleaned. The hardening process leaves a very slight oxidization and there is a little grit left from the coating, all of which must be removed to make a neat appearing file. Stiff brushes are used for some of this work but the great volume of files are cleaned in a steam cleaning device which shoots a spray of steam, water, and a little of the finest sand against the surface of the files. The apparatus is something like a sand blast—a metal casing protects the workman and confines the spray and is supplied with an overhead exhaust; a door in the front is so placed that the jet strikes the files as they are inserted one at a time and as fast as they are put in, turned over, and taken out when they are cleaned. Sulphuric acid is used for cleaning and sharpening to a limited extent.

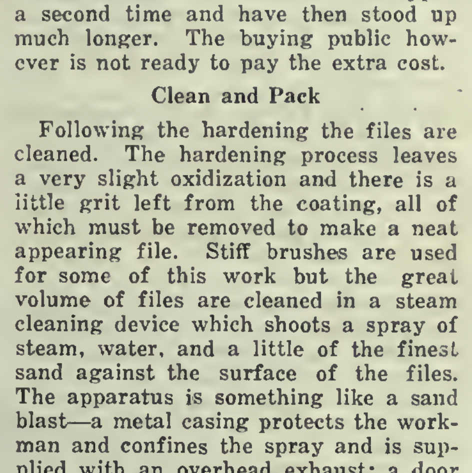


FIG. 27—SKETCH OF HARDENING MACHINE AND HOW WORK IS HANDLED.

Immediately after cleaning the files are oiled to prevent rusting. Then they are wrapped in manila paper and put in boxes. Efficient methods are followed in this seemingly ordinary operation and a marked economy of time and wrapping paper is effected. Instead of rolling the dozen files in a long strip of paper completely enclosing them and forming more than one thickness at a number of places, paper coming in perforated rolls is used. The distance between perforations is equal to two sides and one edge of a file, it will therefore protect four flat surfaces, to say nothing of the one edge. This paper is drawn out over the box which is resting on the bench in suitable guides and a file is dropped in the center of each space; the perforations break as the file reaches the bottom and its sharp corners cut the already partly severed strip. Another packing that is used in these days of paper shortage is to lay pasteboard strips between the files as they are placed in the boxes—this is quick and all sufficient as the sides of the box are ample protection for the file edges. This method is economical and quick.

Rasps

Rasps are made of a low grade of steel, primarily because steel of higher carbon will not stand the bending and compression which a rasp tooth must without breaking. So low in carbon is this steel that only the thin points of the teeth harden at all but this is sufficient for the work rasps have to do. Fig. 24 shows rasp teeth in perspective and in section. They are cut with a round nose chisel—this leaves a half round gouge in the flat surface of the blank and the metal thus thrown up forms the tooth, the end of the chisel making the straight side.

Formerly rasp teeth were cut by hand by the workman who sat before a bench on which the blank was strapped down and who used a hand chisel which he drove by a sort-handled hammer having a peculiar bludgeon-shaped head weighing several pounds. The workman spaced the teeth by eye, experience enabling him to turn out a wonderfully regular piece of work. Needless to say, he worked slower at this job in the afternoon than in the morning, and the physical powers of a human being limited the production. In the days before the wide use of the automobile there was a big demand for horse rasps, and it was a profitable branch of the business; the rows of men engaged in cutting rasps were later replaced by the rasp cutting machine.

Fig. 25 shows the principle on which this machine operates. The blanks are held much as are file blanks, and the table travels under the chisels in much the same manner but the table travels between the uprights of the machine, and there are two of the half round chisels held in the chuck, producing two teeth at one blow. By a side movement the whole of the width of the blank is covered. In Fig. 25 the heavy shaded part is the blank. Reference to the left hand figure shows that the head travels in curved guides—this gives the teeth a little more or the throwing-up cut imparted by the hand cutter.

With hand cutting, rasp teeth naturally varied a little in height, nor is this altogether eliminated in the machine-cut article. Where the best of work is turned out a higher price is gladly paid for rasps that have been evened off, as a single high tooth will score quite badly and necessitate further dressing down of the work. This evening-off process is done like cutter grinding—just the tops of the teeth are touched by the emery wheel and these are given about 15 degrees of clearance. The work is done on a grinder specially constructed for this purpose, an index finger rests against the row of teeth being levelled off and a slide on which the rasp lies is an easy fit in ways that allow slide and rasp to be moved by hand. Rasps so bettered sell for $1 to $1.50 more than the run of the shop.

In connection with prices at the present time, a comparison with those of a decade ago is interesting. The steel alone now costs more than the retail price of the files then. For instance, 14 in. flat files once sold for $2.50 a dozen Twenty-one pounds of steel went into their make-up—hardly a profit for handling the steel, you say, let alone paying a cent towards the bigger item of manufacture, but at that time the best of file steel cost only 3 to 3½ cents a pound!

NAVIGATING INSTRUMENTS USED ON AIRPLANES

Before an airplane can be put into military service it must be equipped with nine or more delicate aeronautic instruments, some of which are absolutely essential to exact flying, and all of which contribute to the successful operation of a plane. Without them a pilot would soon lose his location as to height and direction; he would not know his speed through the air, the speed of his propeller, the amount of gasoline in his tank, the temperature of his cooling water, or if his oil was circulating He could not tell whether he was banking properly on his turns. These comprise the necessary flying instruments, but an aviator could not fly to any great height without another valuable instrument, an oxygen supplying apparatus, nor could he operate his guns, signal headquarters, release his bombs, or "shoot" his cameras without additional mechanisms.

Two Sets Sometimes Necessary

All these instruments must be ready for installation on the airplanes as soon as they are assembled, for no plane is complete without them. In some instances, particularly for the two-seaters and the heavy bombing machines, two and even three instruments of each sort are necessary, totalling sometimes as many as 23, but for ordinary work only about nine of them are needed. The average cost of a set of navigation instruments for a single plane is $350.

For operation of actual combat planes, such as observing, photographing, bombing, and fighting planes, many other complicated and expensive instruments and sets of apparatus are necessary. Among them are machine guns, gun mounts, synchronizers, bomb racks, dropping devices, bomb sights, radio, photographic, and oxygen apparatus, electrically heated clothing, lights, and flares. The cost of such additional accessories would bring the total cost of equipment for a plane to several thousand dollars each, depending upon the type of plane. But these devices will not be discussed in detail here.

Foreign Models Improved Upon

When the American air programme began to be developed none of the instruments now so vital to the service was being produced in quantities, and some of them were not being produced at all. Over 60 per cent. of these instruments had to be developed from foreign models, and the remaining 40 per cent. was secured by modifying or remodeling American automobile-type instruments. Numerous and serious difficulties were encountered in designing instruments, capable of quantity production, of the lightest possible weight and under exacting requirements as to accuracy. During this pioneer work new instruments were being developed abroad almost daily, each new design carrying an improvement.

Most of the work in this connection was done by the Signal Corps in conjunction with manufacturers. All available information and data were collected, foreign and domestic models and types were carefully tested, designs were standardized, and specifications prepared. Results show that types for every class of instrument have been adopted and put into production here. Far greater standardization has been reached than exists in Europe to-day, tending to increase quantity production materially and decrease the number of replacement parts necessary.

Some of the Instruments

Various instruments developed by the Signal Corps include:

The tachometer, or revolution counter, is an instrument which indicates the number of revolutions per minute at which the engine is running. Unlike the speedometer on an automobile, it does not translate revolutions into miles per hour; another instrument gives the speed in relation to the air. When instrument matters were taken up last July there were no tachometers manufactured in this country of the type which has proven most successful abroad; namely, the escapement or chromatic type. Two large manufacturing companies are now turning out these instruments in large quantities, one of them 100 a day, and a third company has also in production a new centrifugal type.

The Air Speed Indicator

The air speed indicator is a pressure gauge for showing the speed of the plane in relation to the air, not the earth. This instrument includes what is known as a Ventuvi-Pitot tube, which is fastened to a strut and takes in the air from ahead. The air sets up a corresponding pressure in an auxiliary tube, which is calibrated and indicated on a dashboard recording pressure gauge.

The altimeter is an aneroid barometer graduated to read height above the earth instead of pressure. Under standard specifications a reduction in weight and size was effected in the manufacture of these instruments, which are now being produced in large quantities and of a quality equal to the best foreign make. Three standard types are made, with ranges of 20,000, 25,000 and 30,000 feet. Production was up to 500 a week in April.

The Airplane Compass

The Airplane Compass.—After much experimental work this instrument has not yet reached the perfection desired. A new type, having advantages over any present form of compass, especially as to compactness, is now used. In the development of this instrument effort has been made to reduce the weight to the safest possible minimum and to decrease the space required in the airplane. One concern is now turning out compasses at the rate of 200 a week.

Airplane Clocks.—Due to the development which had been made in clocks for automobiles, it was only necessary to standardize a design of mounting in order to adopt such clocks to airplanes. Sufficient quantities are now available for all needs.

Pressure Gauges.—Instrument-board pressure gauges were already manufactured here in large quantities, and as soon as standard specifications were developed production started. Two types are used, one to register the air pressure which forces the gasoline to the engine and the other to show the pressure produced in the oiling system by the oil-circulating pump. Standard forms of cases and dials with interchangeable glasses and bezels have been designed.

The Radiator Thermometer

Radiator Thermometer.—This instrument is mounted on the instrument board where it indicates the temperature of the cooling water in the engine. Undue heating shows that the engine is not running properly or that more water is needed. Thermometers of this type made here were, and still are, being submitted to extensive tests. Efforts were also made to stimulate the trade toward developing more accurate and reliable instruments, and now a sufficient supply is available from two sources.

Banking Indicator.—This is an instrument used to show when a plane is correctly banked in making a turn. Spirit level, balance, and gyroscopic types are being used. The problem of indicating the extent to which a plane is inclined to the horizontal in the air is a very complicated one. No simple solution has yet been reached. Fortunately, it is not often necessary to determine whether the plane is exactly horizontal, except in connection with bomb dropping. Development work is under way which it is hoped will lead to improvement of devices already in use abroad.

Aldis Sight.—This sight, which is used in connection with fixed guns firing through the propeller, has been copied, as regards its optical features, from an English instrument; but the construction has been modified in such a way that the behavior of the instrument in actual use will probably be very much improved. After a number of tests and experiments satisfactory instruments are now available. The makers have been assisted in recomputing the lenses to suit the optical glass available in this country. The illumination of these sights for night operation is also being studied.

Research the Mainstay of a Nation's Industries*

The National Research Laboratory of England Has Been a Potent Factor in Overcoming England's Industrial Handicap and in the Placing of Her Scientific Work on a Par With Germany's—The Author, in a Paper Delivered at the Royal Institution, Describes the Organization and Some of the Work it Has Accomplished

By SIR RICHARD T. GLAZEBROOK, C.B.

SOME seventeen years ago I spoke in this room on "The Aims of the National Physical Laboratory." I endeavored to make clear the reasons for its establishment and to indicate some of the work we hoped to accomplish. I concluded: "It has been my wish to state in general terms the aim of the laboratory to make the advances of physical science more readily available for the nation and then to illustrate the way in which it is intended to attain these aims. I trust I may have shown that the National Physical Laboratory is an institution which may deservedly claim the cordial support of all who are interested in real progress."

Much has happened since then: how far we can assert that we have made good is for others to say. At any rate our growth and the generous aid we have been given by many valued friends is evidence that the support for which I asked has not been wanting. And now that another great change in our position is about to take place and, as I trust, a wider sphere of usefulness is offered to us, it is not unfitting to put on record something of what has been done and to indicate, though it must only be in general terms, plans for the future. "Plans for the future": to-day it is hard to plan; one thought only fills all our minds, and every effort is needed to secure that victory without which future plans are useless.

Statistics

Let me commence, then, with a few statistics as to growth and work: In 1901 the staff consisted of three scientific assistants working in some small rooms at the Kew Observatory, and the old observatory staff; the income was perhaps £5,000. When I lectured last arrangements were in progress for moving the laboratory to Bushy House, Teddington. To-day—or rather from April 1 next—we shall be organized in eight different departments, each with its own superintendent and a large staff of scientific assistants and observers. The staff now numbers well over 500 persons, of whom about 180 are women. The expenditure during the current financial year will be considerably above £100,000. Quite recently several acres of ground adjoining the laboratory have been secured and large additional buildings are being erected; these are required for urgent war work.

Many of these have been erected by private generosity. Thus, Sir A. F. Yarrow gave £20,000 for the William Froude National Tank, Sir Julius Wernher erected the Metallurgical Laboratory at the cost of £10,000, Sir John Brunner gave £5,000 to the Electrical Laboratory, while many friends—including the Royal Commissioners of the Exhibition of 1851—contributed to the administration block (Fig. 1) and the Optical Laboratory erected in 1913 at a cost of £20,000.

FIG. I. THE ADMINISTRATION BUILDING OF THE NATIONAL RESEARCH LABORATORY.

As to finance, it may be of interest to give some figures. The ordinary expenditure—excluding sums spent on capital account—increased from £5,479 in 1900 to £38,003 in 1913-14, the total income from January, 1900, to March 31, 1914, being £282,545. The sources of this income were distributed thus:

Treasury grants to the laboratory	£80,500
Treasury grants for aeronautics	20,182
Receipts for work done	166,633
Donations	15,230
	£282,545

During the same period the capital expenditure was £156,198, provided thus:

From Treasury grants	£75,941
From private donations	55,967
Provided out of income	24,290
	£156,198

The enormous growth in expenditure from £38,000 in 1913-14 to over £100,000 this year is, of course, due to the war.

The growth of the personnel has been already alluded to. On the executive committee the changes have been numerous. Of the original members, all of whom gave untiring work towards the promotion of our interests, we have lost Sir Courtenay Boyle, Sir John Wolfe Barry, Sir Edward Carbutt, Dr. Elgar, Sir Andrew Noble, Sir W. Roberts-Austen, and Sir Arthur Rucker, while, in addition, from the names of the original general board the following are missing: Lord Kelvin, Sir William Huggins, Sir Michael Foster, Professor Ayrton, Dr. L. Mond, Sir William Preece, Sir Joseph Swan, and Sir W. Wharton. Sir John Wolfe Barry's recent death will be felt as a severe loss, not only to the laboratory, where he was welcome as a wise councellor and a real friend, but to all the numerous institutions with which he was connected. We are happy in having Lord Rayleigh stil las our chairman; his hand has steered us through many difficulties, and to his consistent support much of the success is due.

Growth

During this period the ultimate control of the laboratory has rested in all particulars with the president and council of the Royal Society. They have been responsible for the finances of the institution. Any loss—I am glad to say there has been no loss—would have fallen on the funds of the society; the laboratory, in spite of its name "National" has really been a private concern of the Royal Society, supported most cordially throughout by six of the leading technical societies, and dependent for part of its income on a grant-in-aid from the Treasury, but in the main from the receipts from fees.

From April 1 next there is to be a change. The scientific control of the

FIG. 2. THE ROLLING MILL.

laboratory is still to be exercised by the president and council of the Royal Society the property of the laboratory is to be vested in the Imperial Trust for the Encouragement of Scientific and Industrial Research—it is now vested in the Royal Society. The income of the laboratory, including receipts from fees, is to be vested in and is to be under the control of, the committee of the privy council for Scientific and Industrial Research. The laboratory will be managed by an executive committee appointed as heretofore and containing representatives of the great technical societies. In this manner it is hoped to secure financial stability and to retain at the same time the great benefits which have come from the close connection with the Royal Society.

In the future, as in the past, the laboratory will endeavor to discharge two functions; it will be a laboratory of industrial research, and a national testing institution or proving house. To-day we deal with the Laboratory of Industrial Research.

Industrial research—What is it? In recent years much has been written on this subject; the idea of a laboratory devoted to industrial research is by no means novel, and the steps by which ordinarily a scientific discovery develops into a manufacturing process are generally recognized. First and foremost we have the research student impelled by his thirst for knowledge, his desire to penetrate ever deeper into the mysteries of nature; he does not work with the deliberate intention of making something of service to humanity. Faraday's discoveries of electromagnetic laws, made in this building, were at first as useless as the new born babe, but had within them that power and potency which has transformed the industry of the world. Rontgen, when he discovered X-rays, or J. J. Thomson when he tracked down ions and corpuscles in the manner he has often demonstrated here, thought little of their application to surgery and the countless benefits they have brought to suffering humanity.

There must be institutions where research work is carried on for its own sake, where—to apply Sir J. J. Thomson's recent remark—men may make discoveries which may revolutionize and not merely reform the world, where they may train students in those fundamental laws and principles which must be at the root of every successful endeavor to apply science to industry. But there is a wide gap between such homes of science and the works of the manufacturer, and it is to fill this that laboratories of industrial research are needed.

Optical Glass

Abbe realized in 1876 that British optical instruments had reached the highest development possible until a radical change was made in the properties of the glass used for lenses; it took years of patient labor, aided by subsidies from the Bavarian government, before he and Schott were able to place Jena glass on the market. Von Bayer discovered synthetic indigo about 1880, but it was not till twenty years had passed that the Badische-Anilin-Soda-Fabric produced it on a commercial scale. Long and patient inquiry was needed in the great laboratory of the General Electric Company, of America, at Schenectady before the Coolidge tube was developed from the original X-ray tube. The work of the discoverer needs development and extension before it can be utilized by industry. This is the task of the Laboratory of Industrial Research.

Or. again, looking at our problem from the opposite side, a manufacturer has some question to solve—the utilization of a waste product which if it were not waste would make all the difference between commercial failure or success, the discovery of a material with some special properties—e.g., a light alloy of great strength at a high temperature—needed before a new machine can be completed. Such a man must have access to a laboratory fitted and equipped for the purpose with a trained staff having stored experience as the result of previous work or researches on cognate questions. Let me try to indicate some of the methods in which the National Physical Laboratory has endeavored to fulfil these duties.

Three of the researches referred to in my earlier lecture related to the production of optical glass, the work of the Alloys Research Committee of the Institution of Mechanical Engineers, and the measurement of wind pressure on various structures and surfaces. On all these subjects much has been done. It was some time before the authorities could be persuaded that in neglecting to study the production of optical glass in England they were adding seriously to the risks and dangers of war. Many years ago a strong committee, formed under the chairmanship of the late Sir David Gill, took the matter up and laid before the government a scheme for a complete study of the problem. Nothing was done until war taught us the need of attending to key industries, but since then real advances have been made, not only at the laboratory but elsewhere also, and some of the more serious difficulties of the problem have been overcome; it is hoped that in the near future it may be possible to introduce changes of procedure which will greatly simplify the process of manufacture and lead to an increased output. Closely bound up with this is the study of the properties of refractory materials used in furnaces and elsewhere.

Microscopy

The application of the microscope to investigate the mechanical properties of metals and alloys was comparatively in its infancy in 1901 when I called attention to the then recent work of Professor Ewing and Mr. Rosenhain on slip-bands. At the laboratory the study of alloys, principally perhaps the light alloys containing large percentages of aluminum, has been almost continuously pursued first by Dr. Carpenter and now for some years past by Dr. Rosenhain. The various reports of the Alloys Committee of the Institution of Mechanical Engineers must be referred to by those who wish to estimate the importance of that work; it is not too much to say that nearly all the alloys of aluminum now used in the production of aircraft are its outcome. A list of the important papers dealing with this subject presented to the Advisory Committee for Aeronautics would fill many pages of this lecture and our knowledge has been immensely increased thereby. It must not be inferred from the foregoing that the metallurgy of the light alloys is the only branch of the subject which has been studied at the laboratory. A large number of "special investigations" have gone in the various departments. By the term "special investigation" is implied some inquiry into a particular subject made at the instance, maybe of a government department or of a private firm, e.g., the investigation into the properties of a new material or the cause of failure of some machine or process such as a boiler plate, the crankshaft of an engine, or an autogenous weld. For example, the failure of one of the main roof trusses of Charing Cross Station some years ago led to an interesting inquiry into the strength of welds. Thus, certain aspects of the metallurgy of steel have received very full consideration.

But it is sometimes urged: "Why do you need a special laboratory for such work? Can it not be done equally well in one of the university or technical college laboratories? Is it not enough to multiply and organize these, to bring the teachers into direct contact with the manufacturers of their districts and to encourage the students at an early stage to interest themselves in the scientific problems they will have to solve later in their daily work?" To this my answer would be that it is not enough. The primary work of the professor is to teach and to advance knowledge, that of the student is to learn how to research and to apply his knowledge. The professor will, no doubt, keep in close contact with the industry and take his illustrations from the manufactures of his district, but before his students can usefully engage in industrial research they must have a thorough grasp of the principles underlying all research and of the methods of employing them. Industrial problems are usually too complex for students, and, moreover, the answers are wanted too rapidly to make them subjects of a student's exercise; he will learn by failures; by the inexperienced the right road is only found at last after many tempting tracks leading nowhere have been vainly tried. The manufacturer who comes with a problem which cannot wait will be more sure to find a solution if he applies to men whose daily work is to attempt such problems and who have the experience of the past to guide them. Moreover, the plant and equipment required is special; the industrial research laboratory must be fitted on the industrial scale. A rolling mill is not an adjunct required in every technical school where the principles of metallurgy are taught, and yet without a rolling mill (Figs. 2 and 3) the study of the light alloys at the National Physical Laboratory could not have been brought to the pitch it has been. The plant and equipment of an industrial research laboratory are provided for the purpose of applying science to industry. The requirements of students and the educational value of the apparatus need not be studied. There must, of course, be many specialized laboratories of industrial research; much more than the National Physical Laboratory is required. I will return to that point later. At present I merely wish to urge that university and technical college laboratories cannot fill all our needs.

And now let me come back to another illustration of the industrial research done at the laboratory closely connected with our original work on wind pressure. The Advisory Committee for Aeronautics was first appointed in 1908 by Mr. Asquith, as Prime Minister. It owes its inception to Lord Haldane, and much of the experimental work which it has initiated, and which has had so marked an effect on the efficiency of British aircraft, has been carried out at the laboratory. At present there are five air channels (Fig. 4) in practically continuous use, and more are being erected. Some years ago I gave some account of the work by which Bairstow and Busk, starting from Bryan's theory, had solved the problem of stability. It is impossible to tell at present of the progress made since that time, but when the day comes on which the tale can be told it will form a striking example of the work of a Laboratory of Industrial Research, and the results obtained for purposes of war will bear fruit in the rapid progress of civilian aircraft.

Froude Tank

The Froude tank is another department of our Laboratory of Industrial Research (Fig. 5). Built by Sir Alfred Yarrow in memory of Mr. William Froude, and for the service of the nation, he has had the privilege of seeing it repay its cost many times in the services rendered to naval warfare, while the pages of the Transactions of Naval Architects bear eloquent witness to the value of the work Mr. Baker has done for naval architecture generally. I could multiply instances. Perhaps I have said enough to justify the claim that, though with scanty means, we have been a Laboratory of Industrial Research of real value to the nation. In my former lecture I quoted a cynical remark made in regard to an advertisement for staff. It ran: "The scale of pay is certainly not extravagant. It is, however, possible that the duties will be correspondingly light." The first sentence is still true: the staff have falsified the inference.

FIG. 3. THE ROLLING MILL.

And now, turning to the future, let us consider what is to be the position of the institution as a central laboratory of industrial research.

In a lecture delivered in Birmingham rather more than a year ago, shortly after Lord Crewe had announced the formation of the Department of Scientific and Industrial Research, I referred to such laboratories, and I wrote:

"There must be more than one; in many cases an industry can be best served by a laboratory near its principal centre. Large firms, again, may each prefer to have their own trade secrets —this must be so to some extent—and trade jealousies may interfere with full co-operation, but a private laboratory on a really sufficient scale is expensive; too often it becomes little more than what I have called a works laboratory for testing the products of the factory, and for the smaller firms, at least, the only way to secure the full advantage of scientific advance is by co-operation —co-operation in the laboratory, co-operation, with specialization in production in the works themselves."

It has been suggested that I wish to make the National Physical Laboratory not merely a national, but the only bridge between science and industry. This is not the case; let me quote, in order that I may amplify them, the concluding words of the lecture:

"Associations are to be formed representing various trades or industries; the representatives of these will discuss with representatives of the advisory committee and other experts questions needing scientific investigation and, when these are determined, the grant, supplemented in most cases by funds raised privately or contributed by the industry, is to be used to carry them out. Such work needs laboratories, and it is here, it seems to me, that the future of the National Physical Laboratory lies. The lord president spoke in generous terms of the work of the laboratory in the past; its many friends who heard him were grateful for his cordial recognition of our labors, and he indicated a sphere of wider usefulness under less difficult conditions in the future. Let me picture to you what I trust that sphere may be.

FIG. 4. THE SEVEN-FOOT WIND TUNNEL.

"In many cases, no doubt, the researches contemplated must go on in special laboratories arranged and equipped for the purpose—laboratories closely connected with the industry it is desired to help, situated at the great manufacturing centres; but there are many other researches of wide interest and great importance for which a central laboratory is the proper house, a laboratory fitted and equipped in an ample manner, with a trained and competent staff animated like those, my colleagues, who have built up the National Physical Laboratory, with a love for science and yet withal with a keen appreciation of the practical side of the question discussed and a real desire to help our country by the application of science to industry.

"The body controlling industrial science research must have access to a laboratory in which may be studied the many problems which do not require for their elucidation appliances of the more specialized "works" character, or opportunities only to be found in particular localities: where a staff is available, able and experienced, ready to attack under the advice of men skilled in industry, the technical difficulties met in applying new discoveries on a manufacturing scale or to develop ideas which promise future success.

"Such a role the National Physical Laboratory should be prepared to play, such is the future which I trust may be in store for it."

This work has already been begun. The various trades associations have been formed, or are being formed, for the promotion of research on matters of interest to the members of the trade.

Objects of an Association

The principal objects of an association, as they would be laid down in the memorandum of association, may be briefly summarized thus:

(a) To promote research in connection with the manufacture and use of . . . by maintaining or subsidizing existing laboratories and workshops, or, if necessary, establishing and equipping laboratories and workshops.

(b) To retain or employ skilled professional or technical advisers in connection with the objects of the association.

(c) To encourage the discovery of, and investigate the merits of, improvements which may seem capable of being utilized for the purpose of the respective industry, and to take out patents or licences relating to such inventions or improvements and to perfect and develop them.

(d) To support or to establish libraries, collections, or museums necessary for the promotion of the industries concerned.

(e) To publish or to assist in publishing any literature, statistics, or information relating to the subject of . . . that may be of value to members of the association.

(f) To promote in any way desirable the education of those engaged or likely to be engaged in the industries concerned.

(g) To co-operate with other associations or bodies having objects bearing on the work of the association.

(h) To apply to the government for, and to accept, grants of money and other assistance for the purpose of the objects of the association and to discuss and negotiate with the Department of Scientific and Industrial Research and other government department's schemes of research and other matters within the objects of the association.

Each such association will probably require its own laboratory situated, for preference, at the centre of the trade concerned. This will deal with the special problems of the trade, problems which need intimate association with works conditions for their solution and for which the close supervision of men in works is important.

Objects of a National Laboratory

But there are numerous industrial problems which can best be dealt with in a central laboratory; let me give some instances of what I mean. Such, for example, are:

(1) Investigations into methods of standardization or of measurement generally.

(2) Investigations into the physical and mechanical properties of materials used in many trades.

(3) Investigations useful to a trade which has no fixed centre, but is widespread over the country.

Or, again (4) a central laboratory will be of service as a means whereby information as to large questions of general interest, investigated either at the central laboratory itself or at the local special laboratories, may be circulated and time saved by placing at the disposal of any special laboratory requiring them the results obtained elsewhere.

Taking these heads more in detail. I will postpone the consideration of No. 1—standardization problems—to my next lecture. It is sufficient to remark here that the work already done in this direction has been very great, and to point out that unification of standards used in various trades is highly desirable and can only be secured by the existence of a central standardizing institution working in close co-operation with local institutions.

Light Alloys

Turning, then, to (2)—investigations into the properties of materials used in many trades, the work done on light alloys affords a good example of this, work for which the British Aluminium Company have recently shown their appreciation by sending a generous donation of £500 to the funds of the laboratory. They write as follows:

"The board of directors of the British Aluminium Company, being desirous of showing their appreciation of the research work that has been, and is being carried on at the National Physical Laboratory, in connection with light aluminium alloys, and with a view to assisting towards further work awaiting accomplishment in the same direction, have unanimously voted a donation of £500 to the funds of the laboratory.

"A cheque for that amount I have pleasure in enclosing.

"My directors do not wish to make any special conditions attaching to this donation, other than that they desire it to be applied, as and when opportunity offers, towards research in connection with the development of light aluminium alloys, leaving it to your discretion to determine the exact application of the grant, whether as to the provision of instruments and plant, or technical supervision, or in any other direction which may commend itself to you."

"I take this opportunity of expressing on behalf of my board and myself, our satisfaction with the results which have so far been achieved, and our firm conviction that, given time and suitable conditions, still further and material advances will follow in due time, from which material benefit should accrue to industry."

Problems for Research

Or, again, the following are a few of the problems which it has been recently stated need solution to satisfy the needs of one important industry:

(1) An investigation into the physical properties of alloy steels.

(2) An investigation into the conditions affecting the flow of liquid fuel through an orifice with reference to:

(a) Proportions of orifice.

(b) Temperature of fuel and air.

(c) Viscosity of fuel.

(3) An investigation of the stress distribution in irregularly-shaped members —crankshafts and the like.

(4) An investigation into the wear of bearings.

(5) Investigations into the material suitable for valves, cylinders, and other parts of internal-combustion engines.

(6) The efficiency of radiators for such engines.

(7) An investigation into the cause of the lubricating properties of oils with a view of framing a specification for such oils.

It is obvious that the results of all these investigations, while of special importance to the automobile industry, are of great interest to others. Any of them could go on in a properly-equipped laboratory, while it is clear that to carry out many a very complete physical, and in some cases chemical, equipment is needed.

And that leads to another very important point. A special laboratory, if it is to be really of use, must be complete. Many of the investigations just indicated involve thermal and electrical measurements of high accuracy. Elaborate apparatus is involved and a skilled staff to use it. These conditions can only be satisfied if the laboratory possesses a large and varied staff, capable of advising on each special point as it arises, and the necessary outfit of delicate and expensive apparatus. In many instances the difficulty lies in the development of the method of measurement and the calibration and standardization of the apparatus employed rather than in the actual experiments.

Refractories

Or, to take another instance. There have been some conferences lately with regard to research in refractories, and it was clear that there is much work to be done and ample opportunity for the development of research in special laboratories in close contact with the industry, whether at Sheffield, Middlesbrough or South Wales, for steel making and other metallurgical processes, or in the Potteries for the china and earthenware trades. It was clear, too, that there was much work which could best be done at a central institution such as the National Physical Laboratory. Such work, for example, would embrace:

(a) The investigation of the following physical, physico-chemical, and mechanical properties of refractories under service conditions:

Thermal conductivity.
Electrical conductivity.
Thermal expansion.
After expansion and contraction.
Softening point (with and without load).
Thermal endurance.
Crystallography.
Texture (grain-size).
Porosity.
Density.
Permeability to gases.
Penetration by molten metals.
Mechanical strength.
Hardness.
Resistance to abrasion.
Resistance to chemical action.

(b) Standardization of tests and formulation of specifications in each class of material.

(c) A study of the properties of all refractories and metallic oxides associated with them, up to the highest attainable temperatures, with special reference to their physico-chemical transformations.

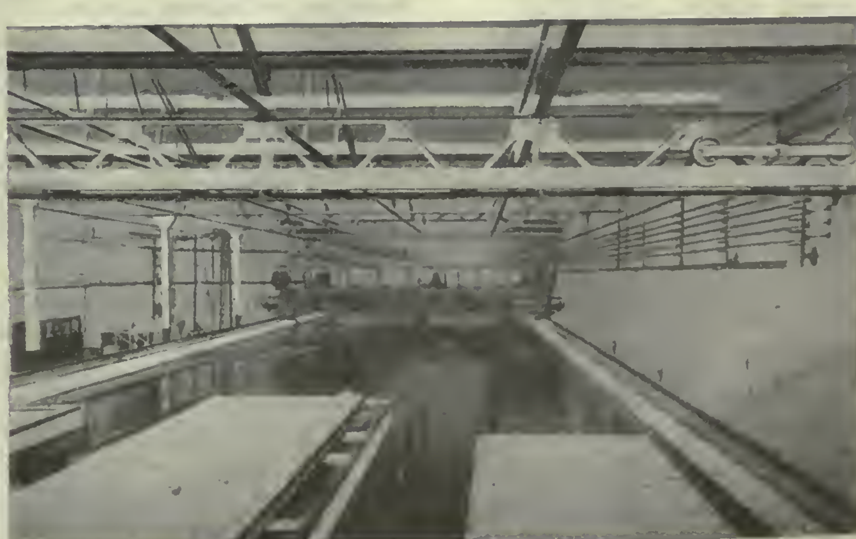
(d) Development of micro-technology as applied to refractories.

(e) A special study of the rarer refractories.

As instances of (3)—Investigations useful to a trade which has no fixed centre—I may give the following:

1. A research has been in progress for some time at the laboratory into the heating of buried cables carrying electric currents. In connection with the Wiring Rules Committee of the Institution of Electrical Engineers much has been done to determine the temperature to which the cables used in house wiring are raised in various circumstances, and to fix the safer currents to be used in each case. Our knowledge of the temperature reached in cables when buried in the ground is very scanty and somewhat conflicting; much depends on the nature of the covering used to protect them, and possibly something on the nature of the soil. Cables laid in ducts, again, differ from those protected merely by the ordinary forms of lead or other covering, and yet the life of the insulation depends in great measure on the temperature reached when the current is flowing and thus regulates the carrying capacity of the cable. Thanks to the co-operation of supply authorities in many parts of the country much valuable information has been collected, and, though the research at the laboratory proceeds but slowly, results of great importance are being obtained. Such a research needs large appliances, and currents up to 8,000 amperes or 10,000 amperes will be employed. It needs also the resources of a fully-equipped physical laboratory in order to measure accurately the temperature differences due to varying conditions; when complete it will be of value to all supply companies. This is true of many other electrical tests and experiments; the results are of wide application; it is desirable that they should be widely published.

The building trade offers another example of this kind. Brick and stone, wood and iron, have been used for long, and their properties when employed for building construction are generally well known. This is less true of other more modern materials—ferro-concrete, for example. There are rules—based no doubt on the best experience available



EXPERIMENTAL TANK FOR SHIPS MODEL TESTING

—for estimating the strength of beams, columns and floors, but there is much scope for inquiry. Accordingly, at the instance of Sir John Cowan, of the firm of Messrs. Redpath, Brown and Co., who is bearing the expense, apparatus is bein built to test columns up to 15 ft. or 20 ft. in length and floors of considerable size. War conditions again are interfering, but the work is progressing slowly and must be done. There are other materials besides ferro-concrete urgently calling for examination. Nor is the strength of the materials the only factor to be considered. Materials transmit heat in very varying amounts and the comfort of a house, to say nothing of the cost of living in it, will depend on whether it is possible easily to keep it warm in winter, cool in summer. Recently we were asked to compare the heat losses from two enclosures exactly alike in all respects, except that the one was roofed with corrugated iron, the other with some preparation of asbestos. It was found that the latter cooled 20 per cent. faster than the former; the loss of heat depends, in part, on the conductivity of the material, in part on the emissivity of its surface, and the superior emissivity of the asbestos sheet more than made up for its inferior conductivity. In this connection it is clear there is much to be done, and for such work a central laboratory, with proper equipment, is the most suitable place. Arrangements are in progress by which it is hoped many of those questions will be thoroughly investigated.

Little need be said as to the fourth section of the work suggested for a National Industrial Research Laboratory.

The importance of the collection and dissemination of information on matters connecting industry and science is clear. At a central laboratory much of the information will be to hand; the accumulated experience of the staff, their knowledge of the work done in the sectional laboratories, their appreciation of the bearing on industry of inquiries in the region of pure science, are all valuable assets and a proper organization only is needed—by means of a bulletin or in some such way—to circulate their information where it is most wanted.

There is ample room for a central laboratory without trenching in the least on the spheres of the local sectional institutions. If the Department of Scientific and Industrial Research is to carry out effectively the work it contemplates such a laboratory is essentiol, and my hope is that the National Physical Laboratory may develop into such an institution in close connection, through the department, with local laboratories throughout the country.

One word in conclusion. The workman is worthy of his hire. In the past the scale of pay has certainly not been extravagant, and there is no call for extravagance in the future, but the remuneration offered must be sufficient and the conditions of work fair. Much has been written lately as to the inadequate remuneration of scientific workers, whether teachers or the expert staff of laboratories and factories, and it is realized, I trust, that the time has come to cange this for men and for women alike. To-day there is a great demand for scientific workers, and while, as in other walks of life, commercial life must offer greater prizes than government service, it is essential, if the necessary work is to be done and the workers retained, that the emoluments of technical posts under government, and the conditions attached, should be as good as those of the regular administrative staff of the civil service. This must apply not merely to the heads of the various institutions, but to the rank and file on whose labors success depends. This point I need not labor here, but in pressing it I feel confident I shall have the support of all who appreciate the importance of science to the nation.

USE OF METAL SUBSTITUTES

The *Norddeutsche Allgemeine Zeitung* publishes the first of a series of articles on the numerous substitutes which the British blockade has compelled Germany to use. It is claimed that the problem has been solved with great success. It is impossible to publish full information until after the war; at present only bare indications can be given. When the blockade isolated Germany, three possible methods of adjusting her metal supply to her metal demands presented themselves: a strict economising of the stocks held, the use of substitutes, and the rearrangement of engine and tool production in accordance with the new circumstances. All these three methods were adopted.

The electro-technical inductry suffered most by the shortage of copper; and, as in the engineering and shipbuilding industries, it had to content itself with zinc alloys containing 4 per cent. to 5 per cent. of copper or 2 per cent. to 3 per cent. of aluminium. In railway and tramway carriages, cast-iron and zinc replaced copper for door-handles, brake-handles, etc. Zinc was also used instead of copper and nickel for buttons, shoulder-pieces, and other decorations on military uniforms.

The optical industry before the war worked almost entirely on brass and aluminium. In place of aluminium it now uses an alloy of magnesium and aluminium, called Elektron Light Metal, which is lighter and firmer than aluminium. The watchmaking and toy industry was likewise badly hit by the metal shortage. There was a danger lest its stoppage should throw thousands of workpeople out of employment, and it became urgently necessary therefore to reorganise it on the basis of substitute metals. At first the watches and toys were plated with copper or brass in order to give them their old appearance. But, before long, even this was found impossible, and people had to content themselves with "field-grey."

After copper, tin was one of the most important metals for which substitutes had to be found. It was used principally for bearings, white metals, and soldering. If no substitute had been discovered for the bearings with 70 per cent. to 80 per cent. to tin, the whole of the munitions industry might have been in danger of stoppage. The situation was saved by zinc alloy and by alloys of calcium and lead. For white metal likewise a substitute had to be found, especially as tins for conserves of all kinds play a very important part in time of war. Other metals, and especially prepared lac, have been adopted as substitutes, while for soldering purposes cadmium has been found suitable.

The metal shortage, and more particularly the shortage of brass, has also been felt in the manufacture of scientific and technical instruments, where brass was used in plates, wire, tubes, and shaped pieces. The whole industry has had to be reorganised, and time and money have been spent in adapting the work to the new conditions. But all this has not been without gain, for many substitutes have been discovered which are likely to be retained after the war. The only necessary condition is that the iron should be malleable, a condition, however, which, in consequence of the scarcity of materials and skilled workers, is hardly ever fulfilled. Iron and steel bars and steel tubes have come to be relied on; but zinc has become the principal substitute for brass. Zinc plates, spherical zinc, and zinc tubes are very much in use; and since zinc by itself is not suitable for working up, excellent zinc alloys have been turned out, only slightly inferior to brass. Naturally, the problem of protecting the surface assumes a very different aspect when iron or zinc is used instead of brass. It has become necessary to plate the surface of the parts with brass, nickel, or (since nickel is also becoming scarce) cobalt. Mostly, however, the zinc parts are given a dark tinge and then covered with a serviceable lacquer. In pre-war days fine instruments looked bright and shiny in their brass; to-day they are dark, opaque, even black, and not seldom field-grey.

The hope is expressed that iron and zinc will continue to be used in Germany after the war as substitutes for foreign metals. Yet regard should be had to the requirements of the instrument-making industry, which before the war worked largely for export, and should therefore be placed in a position to compete effectively with the instrument manufacturers of foreign countries. As the foreign manufacturers will have more copper and brass at their disposal, the German industry must also have a sufficiency of these metals, lest the German product should come to be regarded in the world market as of inferior quality. Even to-day it is not always possible to use substitute metals in the manufacture of instruments. This applies in particular to such as are subject to weather conditions (e.g., nautical and measuring instruments).

In the electro-technical industry conducting-wires of iron and zinc, insulated by artificial silk, or by paper saturated in insulation lacquer, are now employed. —Board of Trade Journal.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

MACHINE FOR ACCURATELY CENTERING SHELLS

ONE of the most difficult operations in connection with the machining of shells has frequently been the cleaning out of the inside profile after the closing of the nose. While extreme accuracy of this particular section is not absolutely essential it is very important that the surface be made smooth and free from prominent ridges or chatter marks, and conform closely to the contour of the bore. Owing to the small opening at the nose after the bottling operation it has often been a problem to provide tools of sufficient rigidity to meet the requirements of this machining detail. In many cases special devices have been designed for this work, but the general practice is the adoption of a boring bar of such a shape as will give the greatest strength for the work required. To do this it is necessary that the bar be released from the turret before it can be placed in or removed from the shell. It has been found advisable, therefore, to maintain as uniform a shape to these bars as conditions will permit so that the cutters and bars can be used interchangeably.

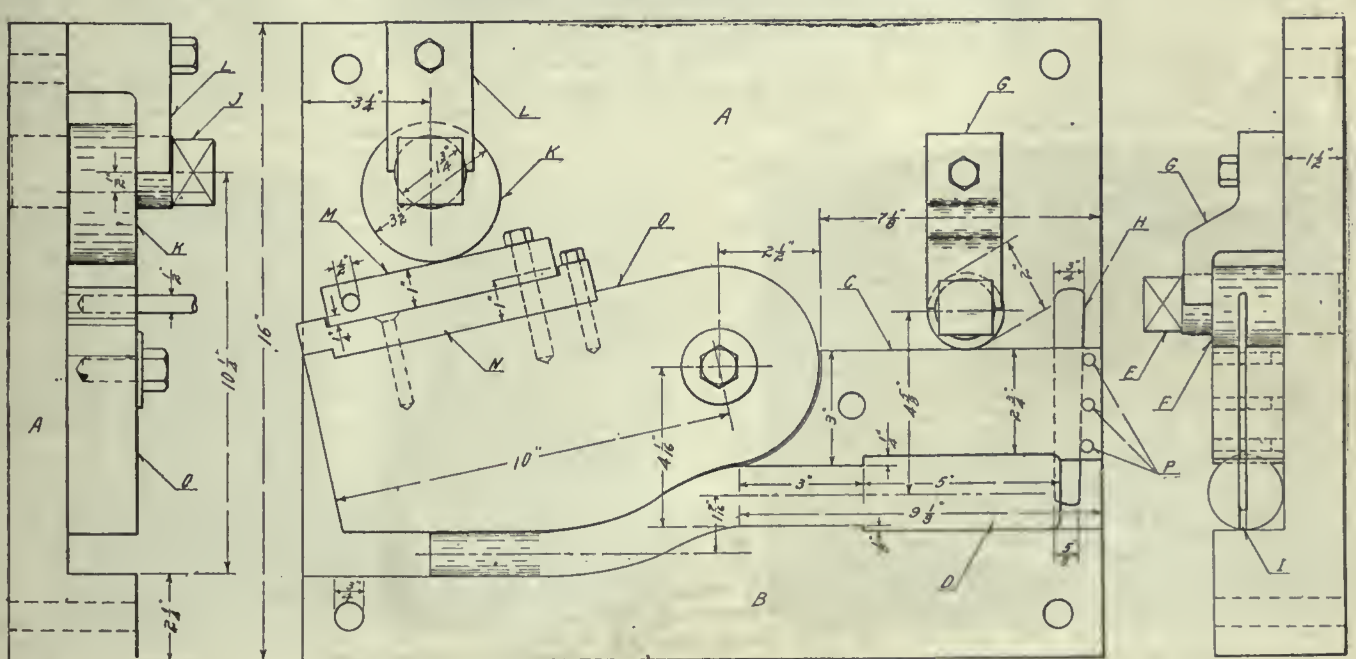
The system adopted at the plant of the Modern Tool Mfg. Co. is to form these bars in a special fixture so that they are virtually identical in every particular. The accompanying sketch illustrates that appliance as now used. The base plate A of the machine is 20 inches long and 16 inches wide, and along one side is the form block B, cast integral with the base. The cylindrical portion of the bar that fits into the hole in the turret is gripped firmly by the clamp C. This clamp is operated by using a wrench on the square E, this square forming the upper portion of an eccentric bolt F, the lower pivot of which fits into a hole in the plate and the upper end supported by the thrust piece G. The lateral position of the bar in the fixture is determined by the wedge H that passes through a slot in the piece C, the tail end fitting into a slot in the rear of the boring bar. This slot has a relative position to the front section of the bar and assures a uniform shape to the latter after bending. The thrust of the wedge is taken by the three pins D.

When the small end of the bar has been turned to the desired shape and size, it is placed in the fixture and bent by the action of the forming block O. This is accomplished by the turning of the eccentric bolt K, this bolt being supported in a similar manner to the one for clamping the large end. Owing to the distance through which the bar has to be bent, it is necessary to perform the operation in two movements. That is, the bar is first bent part way by revolving the eccentric on the block N. When the limit of the eccentric is reached on this block the upper block M is swung into position and the operation is completed. This appliance has given very satisfactory results.

DRIVERS FOR SIMPLE CYLINDRICAL WORK

By Howard W. Dunbar.

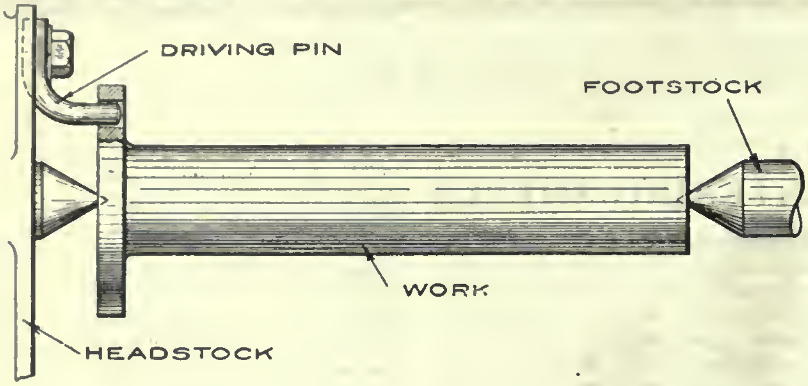
Much of the time consumed in grinding may be chargeable to the handling of the work, the loading and unloading of machine, and provision for clamping the driving means to the piece to be ground. We illustrate this month two simple driving arrangements which readily engage themselves with the work to be ground. They are only applicable to work which has drilled holes in the

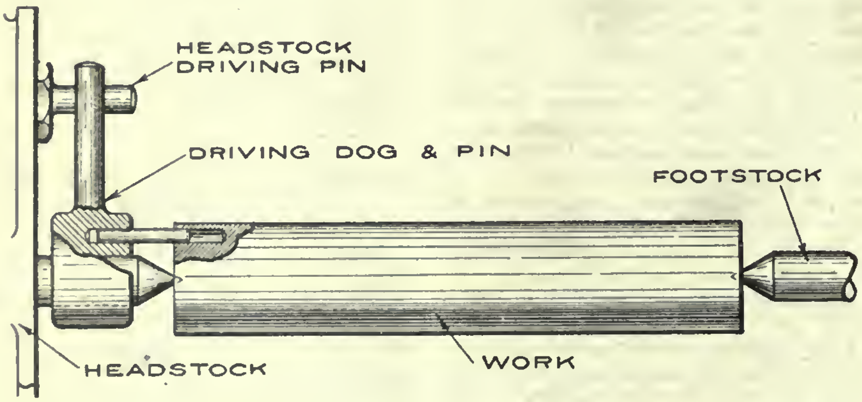


end, which in turn can engage the driving pin, such as a flange shaft with holes drilled in the flange, or pieces in which a hole has been drilled to provide for this driving means.

In one illustration the driver is a loose bushing which fits the centre of the machine and revolves freely about this centre when in engagement with the driving pin on the face plate, and which in turn carries a driving projection that engages the hole in the piece of ground work.

The other illustration is a simpler device which is fastened to the face plate and revolved as a direct engagement with the hole in the piece to be revolved. Both of these features have their advantages, and should be applied depending on the conditions surrounding the grinding operation and the ease with which they fit themselves to each individual case.—*Grits and Grinds.*





THE INTELLIGENT CHECKING OF DRAWINGS

By ROBERT MAWSON

IN the present day rush to get out war supplies, there is a scarcity of designers and draftsmen as well as other branches of engineering industry. This condition has changed very materially the routine of drafting offices.

Before the war the customary practice in most drawing offices was to advance the men according to ability and length of service, from the board to checker, assistant chief draftsman and eventually to chief draftsman. By this process a man gradually becomes accustomed to office conditions and practice, and when he was given the position as checker he was in a fair way to handle it successfully.

Taking the case of the special small tool industry, however, in these war supply manufacturing days the old regime does not hold good. Tool designers are moving from office to office and many of them are given the position of checker who never did the work before. To many people this duty seems the easiest work of all. To them it is simply a case of checking up dimensions carefully or otherwise, as you feel like it, and trusting to the accuracy of the tool designer.

I said in passing, "If you could or had an opportunity to do that work you might find it a rather serious joke."

To the checker belongs largely the success, or otherwise, of the work turned out from an engineering department. With this in mind I have tabulated the chief points which I found most important to be observed when acting as a checker on toool designs.

1. Check if the part to be machined is laid out correctly to scale and see if there is sufficient clearance between it and wall of the tool to avoid interference.

2. See if the surfaces to be machined on the tool are the best design to suit the equipment of the shop.

3. Check dimensions of tool, see if walls are strong enough and not too thick to make the tool awkward to handle.

4. Check if straps and other fastenings are strong enough and are so arranged that the piece being machined may be removed conveniently, also see the nuts, if the tool has any, can be tightened without using special wrenches.

5. See that there is sufficient chip room on jigs, boring fixture and the like, so the chips do not either clog the tool or interfere with the correct locating of the piece in the tool.

6. Check if the tongues on milling fixtures are correct to fit milling machines, splining machine or machine tools when the tool is located by means of tongues.

7. On punch press tools see that the machine has sufficient stroke to suit the design.

8. Check title for correctness of scale, names of designer, tracer, number of drawing dated, also note to have tool stamped. It will be observed that I take up first the checking of the correctness of the piece's layout.

If this has been laid out to the wrong scale the usual consequence is that the tool will be also wrong and interference will occur—see the designer starts out right.

The second point is also important, as often a slight change in design to avoid expensive tooling or sometimes special set-ups will change very materially the cost of making jig or fixture.

As regards the third point, often jigs are designed with the walls so thick and the tool so heavy that it requires two men to handle it.

This can be avoided by coring out walls and ribbing the casting to get the required strength and yet reduce the weight very materially. Checking up fastenings is important as the ease by which those can be manipulated determines the value of the tool as a time saver.

If a case should arise where a special wrench is necessary, see that it is designed and stamped with the number of the tool, kept with it in a box or other means in the tool crib, so that it is at hand when required.

The fifth point needs no comment, as any one acquainted with the use of special tools realizes the value of chip clearance.

As regards the seventh point, if a punch press tool has been designed for a press and it be found that the machine has not sufficient stroke either re-design the tool if feasible, or change it to suit a press having the required length of stroke.

The eighth point is obvious, but it might be added, see that the note calling for the stamping of the tool is plain and unmistakable, if need be underline it.

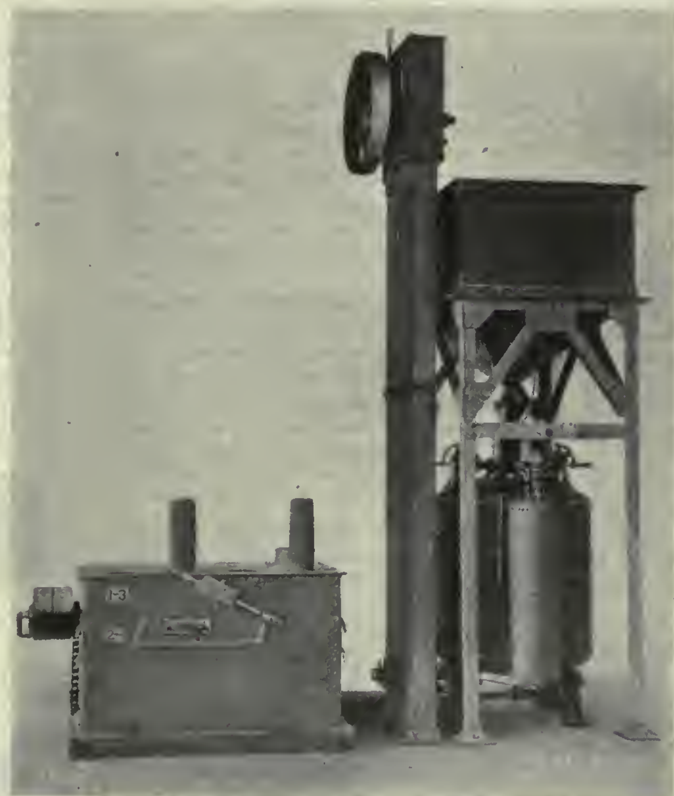
I trust these ideas which I have found useful will also prove valuable to the reader, enabling corners to be cut in checking, back stepping and yet cover the matter so the tool can be sent out into the tool room, knowing that it will be built to do the work successfully and yet the checker feeling he has not slipped on his work.—Robert Mawson, Hamilton, Ohio.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

AUTOMATIC SHELL CLEANING CABINET SAND-BLAST

This machine is designed to provide continuous operation for cleaning 155 mm. shells with direct high pressure. Primarily it consists of a cabinet in which are mounted four rotating chucks driven at slow speed on dust proof ball bearings. The chucks are driven by a belt from a main drive gear at the rear of the cabinet, and alternate chucks revolve in opposite directions. All driving gears and mechanism are contained in a separate dust tight compartment. A direct high pressure sandblast machine supplies two lines of hose feed, two nozzles which are positioned to project within the nose openings of alternate shells. The shells are placed in the rotating chucks opening downward, and as the two alternate shells are cleaned, the nozzles are thrown by a lever on the front of the cabinet to the other shells without stopping the blast action while the clean shells are removed and others placed in the chucks for cleaning.

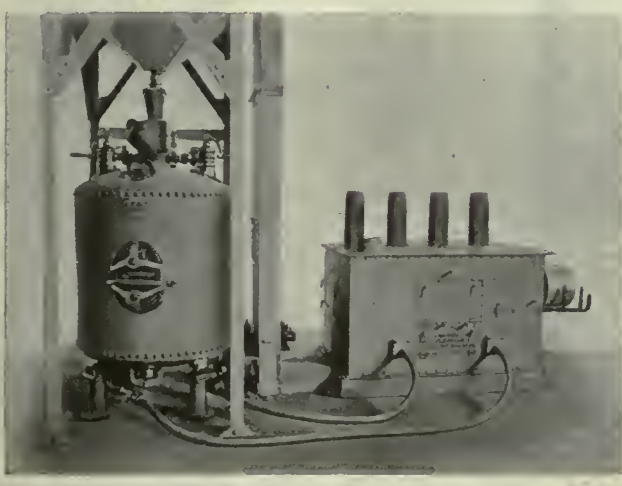


SAND BLAST MACHINE FOR SHELL CLEANING

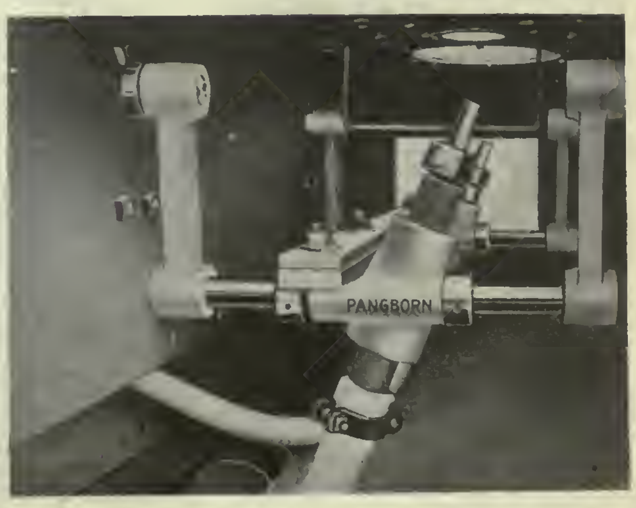
A hopper formed in the bottom of the cabinet receives the spent abrasive which is conveyed to an elevator and rais- to an abrasive separator over the sand-blast machine, which by mechanically operated screens and strong exhaust, at one operation removes both fine and coarse material which passes to a refuse bin, the clean, sharp abrasive for refuse being delivered to a storage bin for refilling the sand-blast machine.

The shells are simply placed in the chucks, which are so designed as to firmly hold the shells in position without other support or attachment, which leaves the top of the cabinet entirely free for manipulation and observation of the shells.

The sand-blast machine can be used with either sand or the metal abrasives, and the equipment in actual practice is cleaning 90 155 mm. shells per hour. The cabinet is also made for other size shells. The illustrations attached show the detail of the chucks and the driving belt, two of the chucks being removed and the nozzles seen through the openings. The lower illustra-

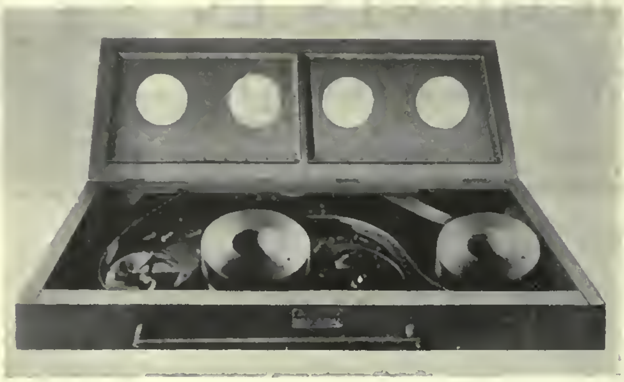


REAR VIEW OF MACHINE



DETAIL OF SAND BLAST NOZZLES

tion shows the hose connection to the nozzles and their method of movement by the lever handle on the front of the cabinet, and a section of the



conveyor can also be seen in the bottom of the separator. This machine is manufactured by the Pangborn Corporation, Hagerston, Md.

RADIAL DRILLING MACHINE

A wall radial drilling machine, as made by the Lynd Farquhar Co. of Boston, Mass., is described and illustrated herewith. This is a well designed and carefully built machine, and special care has been given to locate the entire control of the machine within easy reach of the operator.

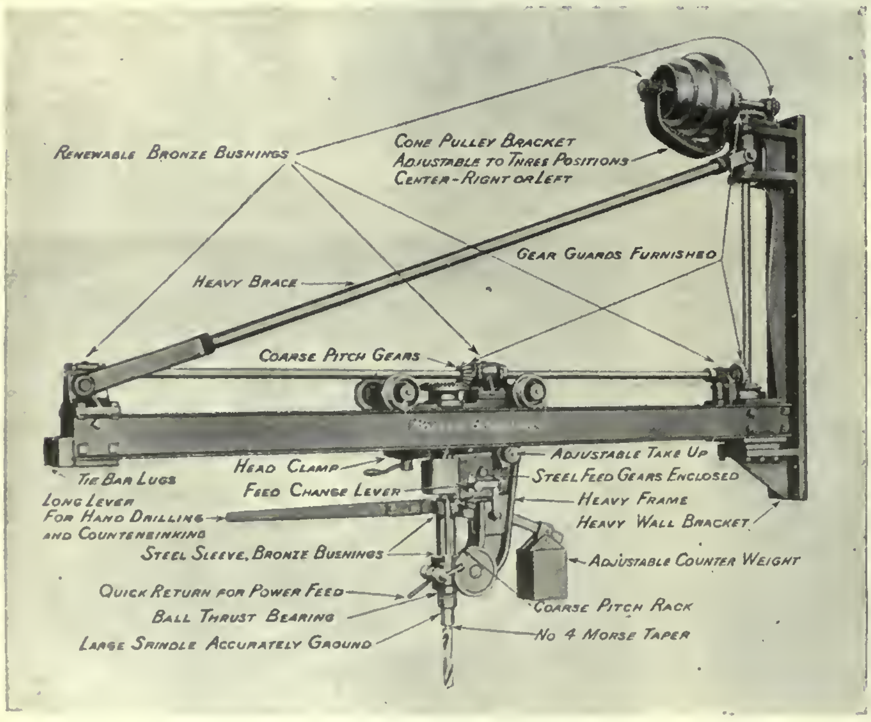
The arm is constructed of extra heavy channels, accurately planed top and bottom, with substantial supporters at each end, and is supported from outer end to top of wall bracket by heavy steel brace bars.

The wall bracket is heavily ribbed, planed on back and where bolted to the wall is 10 in. wide, 6 ft. 10½ in. high. Bracket at top of machine with bevel gear housing can be located at three positions for convenience in connecting belt drive from countershaft.

The motor application is made by mounting 5 to 7½ H.P. variable speed motor on suitable brackets, which will be furnished at extra cost, in place of bracket that carries bevel gear housings.

The head is exceedingly rigid, mounted on four flanged wheels fitted with roller bearings, and moves with extreme ease from end to end of arm. All gears are accurately cut from the solid, feed gears being of steel. The bearings are bronze bushed and renewable. The wheels, carrying heads, are fitted with high grade roller bearings.

A hand lever feed, nicely counterbalanced by adjustable weight for light drilling and countersinking, can be adjusted to remain in any position. The geared power feed has two changes, .015



WALL, RADIAL DRILLING MACHINE

to .025 per revolution of the spindle. Can be changed while drill is in operation, and provides a good range of feed for drills up to 2½ in. diameter. An automatic release of power feeds to spindle is provided at extreme traverse of spindle to prevent damage to feed gears.

The spindle is of high carbon steel, 2½ in. diameter in bearings, is accurately ground, runs in long bronze bushings, (renewable) within a steel sleeve; has 7 in. traverse; No. 4 Morse taper hole, is fitted with high grade heavy duty ball thrust bearing. Upper end of spindle 2⅜ in. dia., and slides through heavy steel driving sleeve to which is keyed the main driving gear.

An adjustable eccentric wheel on under side of arm keeps the carriage in proper adjustment along the channels.

A clamp lever conveniently located, clamps head rigidly to the arm. Tie bar lugs are provided at extreme end of arm to receive tie bar in event it should be found desirable in extra heavy drilling. The countershaft is self oiling, tight and loose pulleys 16 in. diameter, 4½ in. face, and should run 350 R.P.M.

DIRECT CURRENT FACE LATHE.

MOTOR HEAD FACE LATHE

In developing the face lathe shown herewith, the Oliver Machinery Co., Grand Rapids, Mich., have kept in mind the desirability of having a machine tool which would be entirely self contained. The motor head, the controller or switch and the rests are mounted on the floor column, making the machine especially desirable as a portable face lathe. All the electrical parts are totally enclosed—dust proof.

The lathe swings 24 inches over bracket, 20 inches over rest socket and will turn work up to 12 inches wide by 20 inches diameter or 6 inches wide by 24 inches diameter. Great care should be taken not to run these lathes at a higher speed than the work at hand will warrant.

The spindle is made of steel tubing selected for strength and durability. It

REAR VIEW OF ALTERNATING CURRENT FACE LATHE

is 1¼ inch diameter and has a ½-inch hole its entire length to facilitate removal of centers. The inside end is threaded for face plates and bored to receive No. 2 Morse Taper Shanks. Outside end carries a hand wheel for holding the spindle for removing face plates, for turning spindle by hand when making adjustments, or for quickly stopping motor. When rear end turning is desired, the hand wheel may be replaced by a face plate.

Either a. c. or d. c. motors may be fitted to the head according to the available supply.

The a. c. motor head will run at 800 to 3,500 R. P. M. The d. c. motor head will operate at 600 to 3,000 R. P. M. The a. c. motor is of the single phase, series-compensated type, and will operate on any single or polyphase circuit of the proper voltage and also on any frequency from 25 to 60 cycles. The wiring from main line to motor comprises two wires only, making its connection simple through the avoidance of a multiplicity of wires incidental to the use of regulators or rheostats. The lubrication is very simple and confined to the occasional filling of grease cups.

The stator frame is constructed of laminated steel reinforced with iron spacings blocks inserted to absorb the thrust, which insures absolute rigidity of the headstock. Speeds from 800 to 3,500 R. P. M. or any intermediate speed may be obtained by simply turning one or the other of the conveniently placed hand wheels. There are no feed rheostats, regulators or relays, the entire controlling mechanism being contained in the motor.

The d. c. motor has a frame made of soft cast steel and which fully encloses all current carrying parts. The upper cover on the commutator end is for inspecting brushes. Polepieces are drop forgings of very high magnetic permeability. Field coils are form wound and thoroughly insulated. Bearings are ring oiling and adjustable for wear. Commutator bars are made of hard drawn copper, insulated from the commutator center and from each other by selected mica. Commutator uses two brushes per stub, eliminating brush trouble and sparking. Armature is mounted on a special shaft constituting the head stock spindle. The core is built up of laminations of soft steel sheet heavily insulated before the coils are wound into place.

FACE LATHE FOR USE ON ALTERNATING CURRENT.

RETURNED SOLDIERS ARE NOT MUCH IN FAVOR OF FARM LIFE

WE spent many an evening in France in our little mess, discussing the problem of what the men would want to do when the yreturned, and how they would be absorbed into the life of the community. From what we had seen we came to the conclusion that many of the men who had been working in clerical positions in cities, now that they had had a taste of life in the open, and had become rugged, would go to the farm in preference to the city. But we have had to reverse that conclusion. We now find that the men, even those who had come from the land, will not go back to the farm when they come home, because, for one reason, they have become more or less gregarious; they have lived together, and men who had lived a lonely life before have now had friendships for years. They have made strong friendships, and they have come to a different point of view on almost everything.

The returned soldier is a man who cares very little for wealth or for position; he will look you right in the eye and tell you exactly what he thinks. I have had men applying for positions who have been private soldiers, and, although I was in uniform, they would come in and talk to me in a way they would not have dared to do had they been in uniform. They have seen things and they realize a good deal of what is real in life. When we talk of the returned soldier we must consider, first of all, his mental point of view. The returned soldiers, particularly those who have been in the field for more than two years, have been and will be to a large extent spoiled for ordinary work. Many things they considered worth while before will no longer attract them. They consider, for instance, that the question of making money is not the greatest thing.

The system under which the wounded man lives, and is encouraged to do nothing, in the hospital, really trains him to be a loafer. He is deliberately trained to do nothing. The first thing to do with the average man when he comes back is to get him gradually broken in to the idea of working and becoming a citizen of the community. I know myself—I came back sick, and I can speak from personal experience—that it has taken me practically to the present time to get the point of view of the civilian that things here are worth while. The man at the front has passed through great experiences, and, when he comes back, the ordinary things of life seem dull and unprofitable. In some way he has to get out of that attitude, which is largely mental.

Economic conditions after the war will play a large part in the absorption of the returned soldiers. Whether competition be great or not, I do not think these men will go on the land unless some means can be provided whereby they can live together and have a community life. I do not think they will consider for one moment going back on those large farms on the prairies.—Col. George C. Nasmith, M.D.

It is not being out at heels that makes a man discontented, it is being out at heart.—Bliss Carman.

The best compensation for doing things is the ability to do more.—Ginger.

Any man is a success who can do his work without supervision.—Elbert Hubbard.

Too low they build who build beneath the stars.—Dr. Young.

A wise man is never less alone than when he is alone.—Swift.

A negative thought is a poison as deadly as arsenic.—H. L. Fogleman.

He who does not advance recedes.—Latin.

I have often wanted Fortune, but oftener Enterprise.—Montaigne.

When you begin to feel sorry for yourself, you have a right to be.—Logging.

Nothing is impossible to industry.—Periander of Corinth.

Success will go a block out of its way to dodge a lazy man.—Sun.

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A Poor Place to Work

HOW is it that municipalities can continue to secure the assistance they require in the way of competent officials? There are two forms of employment that are not desirable. One of these is appointment under political patronage. The other is a position in the gift of a civic governing body. In some cases a mistaken individual may be inclined to regard either of these as sinecures. They have a mental picture of short hours, pleasant offices and easy work. Unfortunately in some political appointments these specifications have been lived up to.

But the average civic official has not a desirable appointment. In Toronto this week we have had the spectacle of the Mayor telling the Medical Officer of Health that he ought to apologize for drawing his salary. Salary increases were threshed out, and the petty raises doled out in many cases were made the cause of prolonged discussions, all of which appeared in print. A man with a good sized backbone stuck into his system would ten times rather go without the miserable increase than have his salary matters paraded before the public in such cheap fashion.

There is many a well-trained official serving in the capacity of city engineer to-day who is simply going to seed because he knows that his official head would come off close to the collar-bone were he to get up and speak the blunt truth about the manner in which civic affairs are carried on.

Pity the man who gets jockeyed into the position where he can't call his soul his own, and where his best accomplishments are simply a second rate performance of the best that is really in him.

Public and Private Methods

WHY is it that government institutions seem so often to lack in the fine precision of detail that makes private operations in the same line a success?

For instance, right now such a condition exists at Vancouver. In the Vancouver *World* of recent date the following appears:—

"Vessels are unloaded, re-loaded and get away from Vancouver just as quickly as anywhere on the Pacific Coast.

That is, some vessels are.

When a C. P. R. boat comes in she finds one empty shed to receive her freight and another full shed to be emptied into her hold. Loading is going on at one end of the ship and unloading at the other.

Also the freight does not accumulate in the shed. There are cars, all the cars needed, to take it away and so prevent congestion. Also switching engines to move the cars.

And likewise at the Great Northern dock.

But not so, not by any means so, at the other docks and at the government dock in particular. There the freight piles up and piles up in great mountains so that it takes a gang nearly twice as big to work a hatch as the gang working a hatch in a C. P. R. steamer.

And moreover, if C. P. R. or Great Northern boats are in the longshoremen find it better to go to them than go out to the government dock, where they are a long way from home and not a solitary restaurant is working at night when a man wants some hot coffee to see him through.

Now that condition is too often indicative of the difference between public and private ownership. The private company has to study actual competitive conditions and meet them. The government can afford to take the position too often of knowing that a deficit is not going to wreck their business. The Vancouver case looks like one that will stand some explanation.

The Viewpoint of Two Men

SOME months ago it was brought to the attention of the Kaiser that one mother had lost nine sons in the war. The German emperor thereupon wrote to her as follows:—

Nineteen-Eighteen

Frau Meter;—

"His Majesty the Kaiser hears that you have sacrificed nine sons in defense of the Fatherland in the present war. His Majesty is immensely gratified at the fact, and in recognition is pleased to send you his photograph, with frame and autograph signature."

What sympathy! What comfort to that heart-broken soul who had sacrificed nine sons while the Kaiser's six, resplendent in all the official trappings of war, are as safe to-day as they were on the first day of the conflict!

The wording of the message is hardly short of blasphemy. Viewing the loss of nine sons with smug complacency the beast of Berlin expresses his gratification!

Abraham Lincoln had occasion to write at the close of the Civil War to a mother who had lost five sons in battle. His letter ran as follows:—

Executive Mansion, Washington, November 21, 1864

Mrs. Bixby, Boston, Massachusetts.

"Dear Madam: I have been shown in the files of the War Department a statement of the Adjutant-General of Massachusetts that you are the mother of five sons who have died gloriously on the field of battle. I feel how weak and fruitless must be any words of mine which should attempt to beguile you from the grief of a loss so overwhelming. But I can not refrain from tendering to you the consolation that may be found in the thanks of the Republic they died to save. I pray that our Heavenly Father may assuage the anguish of your bereavement and leave you only the cherished memory of the loved and lost, and the solemn pride that must be yours to have laid so costly a sacrifice upon the altar of freedom."

Yours very sincerely and respectfully.

A. Lincoln.

There's something in that message of Lincoln's that appeals to the manly man and the womanly woman. There's a depth of feeling and a wealth of heart-felt sympathy that speaks the innermost convictions of a godly man.

There is enough in those two letters to show why United States is with the Allied forces in the greatest war the world has ever seen.

OUR idea of an accomplished man is the chap who can ride in some other person's motor car with that splendid indifference that makes the real owner look like his chauffeur.

* * *

If you're making twice as much money as you used to, don't forget to peel off a ten spot and slide it into your hip pocket occasionally.

THERE'S ALWAYS A WAY UP FOR THE MAN PREPARED

Technical Education With Practical Experience Make a Winning Combination

By A. J. T.

CERTAIN learned books lament that talking as an accomplishment is a lost art. So it is. For in the more practical environment of its new abode—industry—it does not aspire to be termed an art. Nevertheless, one commissioned to find it in a hurry would not search first in the production end of business. But there, and just yesterday evening, this ability to talk interestingly, pleasingly, was found in the person of William C. Beck, superintendent of the Consolidated Optical Company, of Toronto.

"Thirty years ago," said Mr. Beck, "I was 15 at the time and I am about 45 now, so it would be 30 years ago—I did my first work for the Ball Electric Light Company, Adelaide Street, Toronto.

Wm. C. Beck

"The following five years I'll pass up, if I may; for I'm sure I did not greatly help the several firms I worked for, and I'm just as certain that they did not help me.

"Twenty-one years old, with the machinery of a ramshackle brick yard in my care, I rubbed shoulders with dissatisfaction. What was there ahead for me? In school I had not gone beyond the third book. A married man without a trade, without education enough for an office stool, what was there that I could do?

"I left the brick yard and for a time favored the Toronto Electric Motor Company, making rheostats mostly. My wage was to be six dollars weekly. Sometimes it was. But all too frequently one dollar or a single fifty-cent piece was all I obtained for six days' labor. Consequently, if dissatisfaction had been shoulder-high before, here both fists of the old Goader pummeled me.

"To understand my plight you should know what times were like 25 years ago. It was a trying period of industrial stagnation. Men begged for work—and did not get it. Why, even journeymen machinists—the best of them—took their twelve per with a prayer of thanksgiving.

"Groping for a way out, I met Walter Inglehart, then in charge of McFaren Dental Supplies and now, by the way, superintendent of a large Chicago plant. Under Inglehart I made my own patterns and forgings. But this work was heart-breaking, for I knew so little and willed to do so much.

"It was through Inglehart that I started attending the 'Tech.' Three nights a week I went until I had mastered algebra, elementary electricity, steam, machine drawing and machine construction. So at last I was making headway, if not a fortune.

And not long after more money offered; a dollar and fifty cents a week more, with another advantage: The Ballard Electric Machine Company did the finest class of machine work in Toronto. Here I learned to do real good die and tool work.

"Later Wythe & Carter—their plant was the basement of the old Truth Building on Adelaide, almost opposite Sheppard—offered three dollars and fifty cents more. I accepted.

"One day in this plant the superintendent and a man named Bowker came over to where I was picking tools out of snow banked on the work bench below the street windows. Could I make dies for the gentleman? I could.

"Now this man Bowker managed the Ajax Optical Company and had been superintendent of the Standard Optical Company, a United States corporation with which the Ajax was affiliated. He came often with work, always direct to me, and at length intimated that my future with him might be bright. Finally, more money was proffered. Pay for holidays! I can relish the thought to this day.

"I had just nicely got the run of the Ajax plant when I saw a way to cut out expensive machines then in use. The tool I made eliminated these machines entirely. Other ideas of mine were adopted. And when officials of the Standard Optical Company visited our plant, Mr. Bowker gave me all credit for improvements made.

"Moreover, when the Ajax Company merged into Cohen Brothers, manufacturing opticians, all the Ajax workmen except Mr. Bowker and myself were laid off. He agreed to go with Cohen Brothers as mechanical adviser provided he could have me as assistant..

"Well do I remember the amazement of the workmen in Cohen Brothers' plant the first time they saw me sinking cold steel. 'Bill Beck' there and then acquired a spot in the sun. And I think the foreman, sooner than I, sensed what was to follow. Anyway, when I was made foreman, he took the change graciously enough.

"One week-end, a few months later, I was called into Mr. Cohen's office. This was my first personal contact with any one of the three Cohen brothers. I was somewhat nervous but not long being left in doubt. For Mr. Cohen, commending my work, evinced an interest in my future amounting to this: A small holding of stock in the company and a wage increase, part of which would go to pay for the stock. I'd have to pay interest on shares I held, but this was more than offset by the fifteen per cent. dividend this stock was then earning. Further, in the event of my death, it was stipulated that this stock would be turned over to my wife as fully paid up. So you see, from every angle, the proposition was most generous.

"That week-end Mrs. Beck and I talked it over, and of the one possible objection our happy anticipations made light. I refer to Cohen Brothers' superintendent. He was not liked. And although I continued to get along fairly well with him, Mr. Bowker would not and, in consequence, he returned to the Standard Optical Company.

"In time there was talk of another merger and intimations that I stood a chance for the superintendency of the then forming Consolidated Optical Company reached my ears indirectly. The intermediator—a friend of mine—said I was the man for the job. I also thought so and said so, provided I could have a free hand.

"But I was merely 'Bill Beck in the jeans' to our present managing director. Therefore, although he slated me for superintendent, I believe he did the trick with no small amount of skepticism.

"That was ten or eleven years ago. Much has happened since. One thing I'll mention, because it shows the far-reaching effect of my having been prepared when Bowker wanted those dies. The Standard Optical Company offered me over a thousand dollars more than my salary at the time to go into their plant as assistant superintendent, with the position of superintendent an assured thing shortly.

"Respecting salary, however, as it grows I'm afraid a man loses the sense of proportion. Mine increased a round thousand a few months ago. I took it as a matter of course. So I suppose," Mr. Beck smiled in conclusion, "never again shall I thrill to a prospect as I thrilled to Bowker's promised pay for holidays!"

Gladstone's grandson wrote his mother on March 23, 1915, the first day he was at the front: "The length of life which a man lives does not matter so much as what he is able to accomplish in that life."

MARKET DEVELOPMENTS

Tool Trade Receives Impetus by U.S. Buying

U.S. Government Places Orders For Much Equipment For Various Plants—Spanish Influenza Serious Factor in Decreasing Work Production—No Relief in Sight For Steel Plate Situation

PROMISES of relief in the shortage of steel plate and light sheets have shown no signs of materializing as yet. Some of the warehouses have no stock on hand. The War Board continues to cut close on the orders that it allows to pass for filling and in some instances a disposition has been shown to release material for repairs more readily than for new work.

Manufacturing interests in Canada and the United States are being hard hit in many cases with Spanish influenza.

It is reported that plants in the Chester and Eddystone district, Philadelphia, including the Baldwin Locomotive Works, are short 50 per cent. of their workmen. One plate mill's production dropped to one-third last week; it had been operating at over 95 per cent. Some others show a reduction of 25 per cent. in workmen. The Hog Island ship plant is short about 10 to 15 per cent. of workmen. It is reported that Worth Bros. Co., at Clayton, Dela., will close down temporarily. There are said to be 200,000 cases of influenza in Philadelphia, and strict measures are being taken to fight the epidemic. Office forces are badly depleted and much work is being held up. Plate mills are also watching their pig iron and coal supplies closely. The mills buying these materials are using them from hand to mouth and are unable to accumulate stocks for the winter.

Industrial centres in Canada report much the same condition of affairs.

There has been considerable activity in the buying of machinery last week. In the East some large orders were placed in the Philadelphia market, but New York and New England trade was relatively quiet. The United States government dominated the trade in all sections, the Ordnance Bureau of War Department placing orders for tools for arsenals and also buying for manufacture, with whom it has placed contracts for guns, shells, and aircraft. Large contracts are still pending for equipment for gun shops at home and abroad.

Recent activity throughout the industry is reflected in an advance of prices for some lines of tools.

The War Department has approved appropriations calling for the expenditure of several million dollars for additions to arsenals and for several other plants that are executing gun and ammunition contracts.

The scrap market during the past week has been devoid of any changes of interest. Only a fair amount of business is coming in. The orders are smaller than usual, and apparently users in many cases are not inclined to stock up. American points have been reporting a very serious shortage in all grades of scrap, but within the last few days it has come to notice that some of the dealers there are actually in the market with very attractive tonnages of sorted material for sale. Canadian dealers have been contending all along that access to the U. S. market would be a good thing for them, but the embargo has prevented this. It would seem now that selling in the home market, although more limited, is about their only chance.

STEEL PRODUCTION VERY MUCH IN ADVANCE OF ESTIMATES

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., Oct. 16.—The rate of steel production in September was 12 per cent. above the rate in August, which was about 4 per cent. below the rate in four months preceding. The increase even exceeds the expectations that were entertained, based on tre passing of hot weather.

A further and very encouraging fact has come out, by reason of the practical completion of statistics of the country's steel ingot production in 1917. Previously information as to ingot production has come through reports of 29 large companies, which reported monthly. In 1916 these companies made 88.15 per cent. of the country's output, and it has been assumed, naturally, that they contributed about the same amount to the 1917 output. On that basis the 1917 output was about 42,200,000 gross tons of ingots. Now, however, returns from practically all producers for 1917 show that in that year the output was about 43,700,000 tons, or 1,500,000 tons more than has been assumed. The 29 companies contributed only 85.10 per cent. to the 1917 output, presumably by the fortuitous circumstance of other producers having indulged in more new construction than did the 29 companies as a whole.

On the basis that the output of the 29 companies in September represented 85.10 per cent. of the total output, as was the case in 1917, and making allowance for the number of working days, the country produced steel ingots in September at the remarkable rate of 46,800,000 gross tons a year. The favorite estimate of capacity has been not less than about 47,000,000 tons, this estimate being based on actual output in 1916, which was 41,400,000 tons, plus allowance for new construction. Outputs have appeared to fall much below this amount, and the forced explanation has been that on account of war time difficulties, largely the shortage of scrap of good quality, the output feasible under normal working conditions could not be obtained. Now the situation appears much more favorable, and the common view is that October will show a better rate of production even than September. Naturally there will be some decrease with winter weather, but perhaps nothing serious.

Steel Requirements and Supplies

These new steel ingot production statistics permit a close examination of steel supplies in relation to requirements as formulated by the War Industries Board and an estimate of the deficit between supplies and the program, with enquiry as to where the deficit will fall.

It will be recalled that early in July the War Industries Board estimated the steel requirements for the half year at 20,000,000 tons, this being in net tons of finished rolled steel. At the same time it pointed out that the industry had never made more than about 16,500,000 net tons in a half year. There is some doubt whether that statement was strictly correct. Later the board increased its estimate of the requirements to 23,000,000 tons for certain, with a possibility that the total might be 25,000,000 tons. The increases were due, first, to increased demands of the A.E.F. and our Allies, and second, to large demands of the Railway Administration for rails and for cars in addition to the 100,000 bought a few months ago. The board's estimate of supply was increased only to 17,000,000 tons.

There is information available that permits a close estimate of rolled steel supply from the tonnage of ingots produced at about 6,200,000 net tons in July and August, and at about 3,300,000 tons for September, making 9,500,000 tons for the three months. In view of the September rate of output and the expectation that October will do still better, 10,000,000 tons or possibly a trifle more is to be expected for the current quarter, making 19,500,000 to 20,000,000 tons for the half year.

Thus there will be a deficit of not less than 3,000,000 tons between the supply and the estimated requirements, and the question, now that production is speeded to the utmost, is simply where the deficit will fall. Enough is now known to make a rough approximation. It will fall in part upon supplies for the general war program, chiefly by way of reducing the factor of safety that has been used in making up the estimates, and partly upon the commercial industries that have been recognized as helpful in winning the war.

It is certain that some parts of the war program have been allotted more steel than they could currently use, whereby reservoirs have been created against the possibility that speeding up afterwards might draw from these reservoirs Three instances may be mentioned in connection with the prospective reduction in the factor of safety, shell steel, ship steel and railroad steel as follows:

(1) In the past ten days a large shell forging plant at Bridgeport, Conn., has been closed for lack of steel, while a forge shop at Cleveland lost three days' time and is now put on the basis of operating two-thirds capacity. The supplies of forged material have been well in excess of the capacity of the machine shops to make finished shells, and thus the production of shells will continue as formerly, but the reservoir against speeding up of machine shops in future is decreased.

(2) The quota of plates for shipbuilding has been 50,000 net tons weekly for several months past. Several weeks ago a survey showed that fully 1,000,000 tons more plates had been shipped from mills than had been applied to steel hulls. Likewise, there have been many more steel hulls launched than have been completed, because the bottle neck has been the flow of engines, boilers and the thousand and one other appurtenances needed for completing hulls. As the flow of equipment is expected to increase greatly, and as the shipways are certain to launch hulls more and more rapidly each month, it was desirable to have this factor of safety, of hulls awaiting completion, and of plates awaiting application in hulls. Two months ago the Director General of Shipbuilding desired that the plate allotment be increased from 50,000 to 70,000 tons a month, but this could not be done, and there is no likelihood of any increase for some time. Thus, with the steel deficit now so well established it will be impossible to maintain these large factors of safety, but the balance of probability still is that hulls will be launched as rapidly as they can be completed.

(3). The Railroad Administration has been desirous for some time past of receiving 60,000 tons of rails a week, 40,000 tons a week having been furnished. Also, it desired that the 100,000 cars ordered a few months ago be put through, so that additional orders could be placed. The railroads have been functioning quite satisfactorily through the spring and summer, but to cope with winter conditions needed additional facilities to be on the safe side. Now the case is, as stated plainly in an official statement by Chairman Baruch of the War Industries Board, that the Railroad Administration has renounced claim to some of the steel allotted to it in favor of General Pershing, and there is a possibility, with particularly bad weather, of railroad difficulties this winter

As to steel for commercial purposes on the preference list or accorded the lower degrees of priority as helpful in winning the war, there will be still more serious curtailment than there has been and there may be some rearrangement of priorities and preferences to take cognizance of the new conditions when it is clear the steel supply will not stretch through the preference list, and in the case of some products will not last through the priorities, which come before the general preference list. One item in this direction has already appeared. Oil country goods, chiefly tubular products, distributed through jobbers, have hitherto been given B-4 priority, the same as standard steel pipe, whereas when ordered direct by consumers have been accorded B-2. Now the order is that B-2 is to apply also to oil country goods when distributed through jobbers, and the account is to be kept entirely separate from the regular replacement account of jobbers. As the mills cannot increase their output of tubular goods in general, this will mean that jobbers will receive more oil country goods for distribution and less standard steel pipe and even hitherto their replacements, month by month, have been falling somewhat behind.

POINTS IN WEEK'S MARKETING NOTES

United States government places large orders for machine tools and sanctions private purchases for government work.

Spanish influenza is a serious factor in reducing output of munitions and is affecting all the important centres in Canada and U.S.

The scrap metal market reports little change with ample stock on hand.

Several Canadian firms with ample foundry facilities are considering the advisability of making cast steel shell.

The plate situation shows little change with a number of warehouses entirely out of stock.

TRADE WAITS TO HEAR OF NEW ORDERS

On Their Release Will Depend Greatly The Volume of Business for Next Year

Toronto.—Promises of relief in the matter of steel plate and light sheets have shown no signs of materializing as yet. Some of the warehouses are absolutely out of stock in sheets. The ravages of influenza have tended to go even further toward curtailing trade. In nearly every case the steel, iron and machinery business is hit hard. There are departments with no person around to talk business; there are trucks with no driver to operate them, and there are orders with no person to see that they are filled.

The War Board continues to cut close on the orders that it allows to pass for filling. Last week several forging plants applied for plate for ovens in the heat treating process. The first orders were returned, Ottawa wanting to know if the plates were for repair or new work. Apparently the War Board would release material for repairing a plant now operating, while it would hesitate to give out material for new extensions.

The Machinery Business

Deliveries are much better now than

they have been for some time on machine tools of all sorts. As a matter of fact orders that were placed months ago are beginning to see the light of day now, and it looks as though better production results would soon be secured. In a number of cases deliveries are needed, not only by the governments buying the shells but by the contractors, who need the pay for the shells in order to square accounts for the putting in of the plants and the other equipment. Contractors woh have taken on shell work have had to go into a very high market for the purchase of the necessary equipment, and this has put them under pretty stiff obligations in many cases, with the result that they have had to finance pretty close to the shore against the day when their production returns would become a real asset.

There has been a dropping off in demand of recent weeks, but against this dealers report that there are inquiries coming in for machinery that will be used in factories which are already planning for their peace time trade.

More Big Business?

The machine tool trade is waiting now to see if the big business that has been held up at Washington for some days is going to be released. There are a number of conferences going on at present. Undoubtedly the war news of the past weeks has something to do with the volume of business that the dealers are willing to prepare for. Opinion seems to be pretty well divided on war contracts, some of the trade believing that they should play the thing safe now, while others are certain that the call for munitions is not going to fall off for some time yet. It is expected that it may be well on toward the end of the week before any definite announcement is secured on this particular point. On the outcome will depend to a considerable degree the volume of business that will be passing next year. It will make not much difference on present operations, as they are all under contract.

Cast Steel Shells

Several Canadian firms with good foundry practice and equipment are considering the matter of cast shells, and a large amount of these are likely to be called for. In some cases enquiries are out with building contracts for the erection in a hurry of plants to take care of the work. Some of the foundrymen are certain that this form of shell will have to be used in the future if the programme mapped out for production is to be adhered to. The gas shell can be cast, also anything used for bombing purposes, but the cast shell that will satisfactorily stand up against the shock of being fired from a gun is something that has not been brought out yet. Various suggestions are made for the giving of strength to the cast shell, but many of these are so complex and laborious that any advantage that would be gained from having them cast is largely discounted by the additional operations.

Scrap Market Still Dull

Dealers are quite emphatic in stating that the past week has been barren of features. Only a fair amount of business is coming in. The orders are smaller than usual, and apparently users in many cases are not inclined to stock up. The scrap market is a hard affair to gauge. Right along American points have been reporting a very serious shortage in all grades of scrap, but within the last few days it has come to notice that some of the dealers there are actually in the market with very attractive tonnages of sorted material for sale. Just where it came from is the secret. Canadian dealers have been contending all along that access to the U. S. market would be a good thing for them, but the embargo has prevented this. It would seem now that selling in the home market, although more limited, is about their only chance. If United States yards are full they are not going to take on much scrap from Canada even were the embargo to be lifted entirely.

NEW MUNITIONS PLANTS IN U.S. MAKE CALLS FOR RAW MATERIALS

Some of the biggest industrial concerns in United States have put out bids for bessemer iron, but makers are not taking them up. Business that is highly desirable is going begging. The whole output is in the hands of the government, and direct dealing over the head of Washington has been discouraged to the point of absolute disappearance.

Reports on the iron situation are as follows:

Pittsburg.—For the first time in many weeks it can be said that the makers of iron are giving shipments that keep up with government allocations. Production figures show signs of improving, owing largely to the increased quality of the coke supply. Against this, however, is the drawback that as the quality improves the quality is falling off.

New York.—Production efforts are as great as ever in this district, and the peace talk is not having the effect of lessening the pressure. Many of the biggest producers have refused to book any 1919 business, holding their plants at the disposal of Washington.

Philadelphia.—In nearly every case all the sales here are now made f.o.b. smelters, thus shifting freight and war tax to the consumer. Production figures are increasing and sickness has not yet become a factor in holding up the work.

Cleveland.—Since May nearly two million tons of material have been allocated in this district. There is a very small open market left and little business is done in this way.

Buffalo.—Malleable iron is very scarce and the demand is far in excess of the supply.

Chicago.—The call for material for munitions plants increases rapidly. In many cases firms that recently went into the business of fitting out plants are now in shape to take in the raw material.

U.S. GOVT. SANCTIONS INDUSTRIAL PROJECTS; MACHINE TOOL TRADE AFFECTED

Special to CANADIAN MACHINERY.

NEW YORK, Oct. 12.—There was considerable activity in the buying of machinery last week in the Central West, especially at Detroit, Cleveland and Chicago. In the East some large orders were placed in the Philadelphia market, but New York and New England trade was relatively quiet. The United States government dominated the trade in all sections, the Ordnance Bureau of War Department placing orders for tools for arsenals and also buying for manufacturers with whom it has placed contracts for guns, shells, and aircraft. Large contracts are still pending for equipment for gun shops at home and abroad.

Recent activity throughout the industry is reflected in an advance of prices for some lines of tools in the Eastern territory. Makers of sensitive drills have advanced prices 10 per cent., and one large manufacturer of lathes has advanced prices 10 to 15 per cent., while another manufacturer of high speed drilling machines is asking 15 per cent. advance on new contracts.

The War Department has approved appropriations calling for the expenditure of several million dollars for additions to arsenals at Rock Island, Frankford and Watervliet and for several other plants that are executing gun and ammunition contracts. Improvements at the Frankford arsenal, Philadelphia, will cost $1,000,000, about one half of which will be spent for equipment. A large part of this appropriation will be used in the construction of new departments for making cartridge cases. An appropriation of $833,500 has been made for additions to the Rock Island arsenal, Ill.; a large part of which will be for machinery in three lists that have been issued; one of these lists calls for $200,000 worth of tools. Another appropriation of $500,000 has been made for the building of a phosphorus plant at Fairmount, W. Va., which will be constructed and operated for the government by the American Phosphorus Co., of Philadelphia. Still another appropriation of $250,000 has been made for a tetryl plant at Sentre, Mich., including main plant, magazines, power house and boiler plant for which equipment must be purchased.

The Procurement Division, Ordnance Department, has placed an order for one hundred 36-inch lathes with a Cincinnati manufacturer, and has been gathering information in the same territory preliminary to placing contracts for four thousand 20-inch and twenty 4-inch lathes.

The Ordnance Department is about to place orders for shop equipment to be used in the manufacture of Colt's automatic pistols, the orders having been placed for these small arms with the Savage Arms Corp., Utica., N.Y., and with the Lanston Monotype Machine Co., and the S-S-E Co., of Philadelphia. The War Department has also authorized the construction of additions to the plant of the Hero Manufacturing Co., Philadelphia, for making brass, bronze and aluminum products; extensions to cost about $150,000.

The International Harvester Co. has received a contract for 5,000,000 hand and rifle grenades and another order for 750,000 6-inch shells. Orders for rifle grenades have also been placed with another manufacturer in Chicago and with three plants in Milwaukee, these four plants will turn out 140,000 grenades every day. The A. O. Smith Corp., Milwaukee, has accepted an order for making aerial bombs, while the Standard Manufacturing Co., with plants at Pittsburg and Louisville, has received a contract to finish 155 mm. shells. The Best Foundry, Bedford, Ohio, a subsidiary of the American Stove Co., has taken an order to cast and to machine 150,000 6-inch trench mortar shells of gray iron.

Great strides have been made in the manufacture of Liberty motors by plants in Detroit and nearby territory. Recent orders have increased government aircraft orders at Detroit to over one billion dollars. The Willys-Overland Co. has placed orders for $350,000 worth of tools for manufacture of eight and twelve cylinder Liberty motors.

The Flu Hits the Industrial World Hard

In the Philadelphia District Almost a Quarter of a Million Men Are Laid Aside—Instructions That C.M.A. Are Sending Out Regarding Fighting the Malady

THE manufacturing interests are being hard hit in many cases with Spanish influenza. In many cases it is like the old la grippe; in many others the trouble really comes from pneumonia following the first attack.

The best authorities say there is nothing to take as a direct preventive. The only thing in this direction is to try and keep up the powers of resistance to as high a point as possible. In some cases the victim is taken suddenly. In fact it is on record that cases have terminated fatally in eight hours.

It is interfering with production in many centres. In Philadelphia for instance the conditions are as follows:

The ravages of an epidemic of Spanish influenza, grip and colds constitute a serious factor in works' production. It is reported that plants in the Chester and Eddystone district, including the Baldwin Locomotive Works, are short 50 per cent. of their workmen. One plate mill's production dropped to one-third last week; it had been operating at over 95 per cent. Some others show a reduction of 25 per cent. in workmen. The Hog Island ship plant is short about 10 to 15 per cent. of workmen. It is reported that Worth Bros. Co., at Clayton, Dela., will close down temporarily. There are said to be 200,000 cases of influenza in Philadelphia, and strict measures are being taken to fight the epidemic. Office forces are badly depleted and much work is being held up. Plate mills are also watching their pig iron and coal supplies closely. The mills buying these materials are using them from hand to mouth and are unable to accumulate stocks for the winter.

Industrial centres in Canada report much the same condition of affairs.

What to Do

The Canadian Manufacturers' Association is issuing a circular prepared by Dr. Hastings, medical health officer for Toronto. The circular is as follows:

"Influenza is an acute communicable disease and is contracted by coming in contact with the secretions from the nose, throat and mouth of a person who is ill with the disease. For this reason every effort should be made to avoid such contact. This may be done as follows:

"1. The person who is taken ill must go to bed promptly. Early going to bed minimizes the danger of the disease. Furthermore he is thus removed from association with healthy persons. He should be provided with his own toilet articles, eating and drinking utensils, which should be sterilized by boiling after use. All discharges from coughing and sneezing should be collected on a piece of gauze and destroyed by burning.

"2. The attendant should be extremely careful not to touch his own face or mouth with his hands while handling the patient or infected articles in the sick room, and should cleanse his hands with soap, water and a nail brush, and hold for five minutes in antiseptic solution (1 in 40) carbolic, or (1 in 1,000) bichloride, on leaving the patient. In this way the attendant will protect himself from the disease, and if he washes his hands thoroughly will not carry the disease to another.

"3. Every person should endeavor to maintain the highest standard of general health by taking suitable exercise in the fresh air, eating wholesome food, and sleeping with the windows open and arranged so that no draught is produced.

"4. Crowded places such as street cars, mass meetings, moving picture shows, theatres and other gatherings should be avoided at this time.

"5. Kissing should be avoided.

"6. No food should be taken without previously washing the hands, and the hands should be kept away from the mouth and nose at all times.

"7. The nose and mouth should always be covered with a handkerchief in the act of coughing or sneezing.

"8. All persons, especially those engaged in factories, large business establishments, etc., where a number of people are congregated, should report on the first sign of illness and be relieved of their duties. To endeavor to fight off the disease by continuing at work not only renders the severity of the illness more severe, but also exposes others to the disease.

"9. The symptoms in typical cases are as follows: An acute and sudden onset with headache, intense, just behind the eyes, pain in the small of the back, and sometimes in the region of the stomach, elevation of temperature from 101 degrees to 104 degrees with comparatively slow pulse rate. The face is flushed, the tongue coated, and in every case there is some redness of the eyes Great prostration is experienced and the patient usually lies in bed in a 'huddled-up' position. In some cases sore throat and cough are noted, and with many only part of these symptoms are found.

"The temperature becomes normal and the patient recovers within five days, providing complications such as pneumonia, middle ear diseases and affection of the heart do not occur. These may be avoided by prompt and careful treatment.

"Consult your physician as soon as you have reason to suppose that you have the disease."

Putting off an easy thing makes it hard, and putting off a hard thing makes it impossible.

Work as if you owned the place—and perhaps you may.—Elbert Hubbard.

The Buying of Second-Hand Machine Tools

The Age of a Machine and Its Serial Number Are Facts That the Purchaser Should Have Information About—Things That the Purchaser Should Watch With Great Care

By DONALD A. HAMPSON, Assoc. Mem. Am. Soc. M. E.

IN these days of machine tool shortage, every shop has to consider the possibilities of second hand machinery. Some shops, because of limited capital, never buy a new machine at all. It is possible to get satisfactory, profitable service out of a second hand machine tool just as it is possible to get horribly "stung." Any man who has read the advertisements in trade papers for years and studied the photos of machine tools should know pretty nearly all the makes of each kind of tool—if he is one of the coming men, he has formed an idea of the relative value of each and he has mentally adapted certain machines to the work in his own shop. Further, if he has been a student of catalogues and has occasionally asked the price of tools, he should be fairly well qualified to purchase equipment provided he uses his judgment in the matter of prices.

To such a well read person, a visit to both new and second hand displays in show rooms is more or less of a delight—also, if he has been located far from great mechanical centres, it will show to him very little in cold iron and steel that he was not familiar with, on paper at least. In this respect, the man who hails from Mullenfield and who has faithfully studied these aids that the mail has brought to him is generally broader and better informed than his brother mechanic in the great city who has worked in dozens of shops and knows other dozens that hold out good jobs just around the corner.

The Age and Serial Number

The age of a machine and its serial number are facts that should be known when purchasing a second hand tool. Frequently a dealer will say that such and such a machine is a "model 4X, about two years old." The dealer may be perfectly honest and yet there may never have been any but a model 4 made in that size. The writer has found that in most establishments of this kind the salesmen and mechanics know but little about machine tool lines outside of lathes, planers, drills, and millers and often very little wide knowledge of these; when it comes to automatics and keyseaters and turret lathes and vertical millers, they soon confine their talk to generalities in the presence of an advertisement reading man. The latter must select for himself.

During the last four years the sale of emery cloth must have trebled. With no purpose other than to see how some of the smaller places were conducted, the writer went the length of Centre St., in New York, one afternoon ostensibly in search of a No. 2 miller. Almost without exception, the owners were Jewish and ready to do business at any reasonable price—without exception all the places had gangs of men scrubbing for dear life to get the rust and oil off the tools on the floor. Some of the places were smart enough to do the cleaning in a back room, some didn't care, and the emery cloth scraped away right inside the door. Where all the old machines came from is a mystery—any student of the business could and can tell at a glance about the decade in which a machine tool belongs—the oil collecting base, the box type of construction, the belt drive, the absence of outside ribs, their presence, and the artistically curving legs—each is the type of a period as surely as the Ionic and the Doric in architecture.

There are second hand firms with a reputation and a rating that rebuild tools that go out just as good in all respects as new, and that sell a tool that has not been rebuilt on a satisfaction-or-money-back plan; such firms know the products of the past and present right to the last feed pulley and it is a pleasure to do business with them.

This Shop Was Ear-marked

Other houses quote on a machine that has been "overhauled and is in first class condition." Too often the overhauling is of the same kind that Will's boy did on their Ford and the machine, though marvelously polished, has been taken apart and reassembled by a helper of the class that puts "burrs" on chamfered side first. I was looking for a turret lathe in a good sized warehouse not long ago; turret lathes were in the far end of the building and passing down the aisles I made excuses for stopping at other tools on the way. They didn't show much sign of wear and yet I wasn't impressed. Just as the salesman and I reached the turret lathes, a messenger called him back to the office to get a long distance message from N.Y. While he was gone I slipped into an adjacent building which was evidently the "shop" where overhauling was done. No one was in sight then but two boys who were filing industriously on the ways of some large lathes. I asked one of them what he was doing and he said, "Dunno mister, the boss told me to file these marks out (scored V's)—I only come here this morning. Say, I wonder why they don't file these out oftener and make it easier for guys like us." That was all I wanted to know about that place. It didn't take long to decide that the turret lathes were a bit high in price—or so I told the salesman when he reurned—high at any price.

Go Over the Tools Yourself

The best plan is for the prospective buyer to get permission to go over a machine himself. To do this he should go prepared to work in the dirt and have a wrench or two, a scraper, a screw driver, and a twelve inch straightedge (at least) with him for tools of this sort seem to be as scarce in such places as they are in some garages. Permission to investigate the condition of a machine tool is readily obtained and should be taken advantage of; many a weak spot, worn or broken, will be unearthed in this way and again the good condition of another machine will be shown beyond doubt, giving one a feeling of security in writing out the check for the same.

Up in a northern city, the writer was giving an automatic screw machine the "once over" some time ago. Next to the automatic was a No. 5 Brown & Sharpe miller that had been cleaned and polished and repainted until it looked like new. It had really been well overhauled—ways replaned, bearings scraped, worn parts faced up true—but while I was there they did a final job that queered the whole thing. Someone had gouged the table with a cutter leaving a depression an inch wide by about four long. I should have left that as it was or until I had a chance to clean it out with an end mill and set in a piece with three small screws, but in the second hand business appearances count. So along came a husky "wop" with chisel and hammer to fix up the spot. And he really was an artist with a chisel, cutting out a recess nearly an inch deep in a very short space of time (the gouge was only an eighth deep.) Then he produced a piece of steel from his kit which he drove in the hole, peening it down all around the edges until no trace of gap was left. A half hour's work with a coarse file and the spot couldn't be located, but—I thought, "after that peening and the peening effect of the chiseling, how straight are those nicely planed ways?"

The Serial Number Tells It

If the serial number of a machine has been secured, the maker can tell you when the machine left his plant. This is a help, but is not an infallible guide as to the condition of the tool because some machines may have been forced to the limit and had no care while others may have run a few months in a plant which has gone into bankruptcy and left the tools standing for years affected only by the oil and chips that hadn't even been wiped off.

For my own part I prefer to buy a machine as it was used, not "thoroughly cleaned and overhauled." Before that machine gets to work in your own shop, it invariably must be taken apart fore some adjustment or adaptation and during that period you can make your own repairs and clean up. A substantial reduction can usually be secured for taking a machine off the floor "as it stands"—enough to pay for the subsequent overhauling that will be done under your own eye. Except in the better class of dealers' shops that have been mentioned, it is customary to take any machine tool needed in the repair department from the stock coming in and overhauling is done on machines that wheeze and jump and move at the rate of 15 feet per minute. I saw a planer on skids just as it had come out of the freight car planing the table of another planer and I mentally compared the work with what we could do in our own shop where our twelve foot planer would cut straight to a cigarette paper in that length; the "machine tool' in the above named case certainly must have been built before the Civil War.

Many Things Bear Witness

Various telltales are apparent as one looks over a tool. For instance, most tool builders use cap screws and set screws of their own make and design—a little better finished than stock screws, usually case hardened. In the course of years' service these screws get lost or broken and stock screws are substituted; the subtitution of these odd and random length screws in any great proportion is a good indication of long or careless usage. The condition of gear teeth on main drives shows how much pulling has been done—if the clearance between two mating gears is a minimum and the tooth outlines as viewed from the side are sharp when the dirt and oil is cleaned off, that is a good indication of little service or careful usage. Chips tell a story: the presence of them packed in out of the way places, discovered when taking apart, generally means long years of service. Chips of brass only indicate that the machine has done light work, though the speeds may have been high and bearings have suffered accordingly.

The countershaft often tells something about the machine itself. If the hanger bearings fit reasonably well and the loose pulley shows unusual wear, it is a sign that the machine has stood idle much of its time and should be in good physical shape. The lack of the usual shiny coat of paint on overhauled tools lost one sale not long ago. The buyer had examined the machine all around, tried the fits, used a bar to detect any play in spindles and slides, and was about to OK the deal when he noticed witness marks on the spindle boxes—home made ones. Taking the caps off and the brasses out showed a bad case of wear.

Ship Building on the Clyde

Fighting the Flu

WHEN Spanish Flu gets after you and says, "Look here, John Henry, I'm going to hand you a jolt to linger in your mem'ry," don't stop to argufy the point, just touch him on the vest, and say, come on, S.F. with me and be my Sunday guest.

It ain't no use to spar with him or side-step from the Flu; this Spanish gent he sticks, by heck, just like a hunk of glue.

So take him right along with you and put him in your bed, stick water bottles on his feet and a pillow 'neath his head—and fill him up right to the neck with senna and sage tea—and dose him up with liver salts and soak him one, two three.

And plaster mustard on his chest to puncture through his hide, put turpentine and vinegar upon his back and side.

Put camphor oil upon his pipes, stick pills into his throat, and jam him full of purgatives and strive to get his goat.

And old S. F. will stay with you, he'll camp upon the job, to get your help at pushin' up the daisies through the sod. He'll roost upon your shoulder blades, he'll sit upon your dome, he'll pay a visit inch by inch to every rib and bone.

He'll put ten men inside your head with shovels and with picks, he'll put a dozen on your back a-peltin' stones and bricks.

So when you see him comin' now don't stop to fuss around, because he's got you faded when it comes to coverin' ground. Just crawl into your little cot, for senna get a thirst—for if you don't old Spanish Flu may rise and swat you first.—ARK.

The printer sometimes makes you say all sorts of things. Thus last week it was recorded in this paper that a boat launched at Port Arthur had an engine with cylinders 20½ ft., 34½ ft., 55 ft. and 40 ft. When inches grow into feet at such a reckless rate anything's liable to happen. However, we haven't got to stoke to keep that tremendous engine going.

* * *

The *British Trade Review* in a recent issue said:—In Canada there has been instituted a rationing system for householders by which supplies will be given for next winter up to 70 per cent. of last winter's supplies. Amongst other steps to be taken to deal with the situation is the erection of a briquetting plant. This has been done on the recommendations of the Advisory Council for Scientific and Industrial Research, which has considered the possibilities of utilizing the coal supplies of Western Canada at points other than those in the near vicinity of the deposits. Western Canada has immense deposits of coal, but it is of poor quality.

If the chap who made that reference to Western Canada coal has not been fighting on the western front, he can have all the sensations of war by going to Western Canada and looking up the Alberta coal operators.

* * *

Fire losses in Canada amount to $30,000,000 annually. On economic grounds such waste is folly. Canada is faced by a national debt of almost $1,250,000,000. Can the people of Canada afford a national bonfire costing $30,000,000 a year? On patriotic grounds, such waste is a dereliction of duty. The ravages of fire cost more than money. Fire takes its toll in food, in munitions and in clothing and equipment, all of which spells loss of life "over there." Germany's strong ally is the fire scourge of the United States and Canada.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	100 00	95 00
Spelter	10 75	11 00
Lead	10 50	10 00
Antimony	16 00	18 00
Aluminum	50 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 37

Standard Buttweld	Black	Galvanized
	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	30 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws list plus	20
Collar screws list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts add 40,	10
Cold pressed nuts to 1½ in. add	$4 50
Cold pressed nuts over 1½ in. add	7 00

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	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

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Cut nails	5 70	5 65
Miscellaneous wire nails		60%
Spikes, ⅜ in. and larger		$7 50
Spikes, ¼ and 5-16 in.		8 00

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Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
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British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

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CANADIAN MACHINERY
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October 24, 1918. Volume XX. No. 17.

Principles and Practice of Mechanical Drawing

In Article Six the Author Takes Up Conventions Relating to Finish Marks, Dimensioning, Notations and Lettering.

By TERRELL CROFT.

Article VI.—Finish Marks and Some Other Conventions

AN example of the value of the ability to render understandable sketches came recently to the attention of the writer. A number of candidates were taking an examination for a first-class engineer's license. This question was asked: "Assume that you have under your charge a condensing alternating-current turbo-generator unit and that you must put this unit, which is standing idle, into service in parallel with another similar unit. Describe the operations which it is necessary to follow in doing this. Name the different devices and apparatus involved and describe briefly the function of each device and its relation to the complete unit."

The answer which was by far the most satisfactory was given by a middle-aged man who had grown up through the ranks. The reason that his presentation was the most logical and understandable was that he submitted a sketch indicating graphically the different components of the equipment and their relation to one another. He was the only candidate who did use a sketch. His rendering was neat, simple, effective and constituted in itself ample evidence that he had studied sketching as a means of bettering his position and prospects. Because of his inclusion of the sketch and his utilization of reference letters on it, his written description was quite brief. He obtained his license.

The other candidates consumed pages of paper in trying to describe operations which they were, doubtless, quite competent to perform. But it is questionable whether anyone, with only these verbose written directions to guide him, could gain a reasonable conception of what the writers were endeavoring to describe.

Finish marks must be used on practically every mechanical drawing or sketch. It is unnecessary to finish certain surfaces of the component parts of machines or equipment. These parts may remain "rough" just as the castings come from the foundry or as the metal stock is received from the jobber. Such surfaces may be painted or otherwise treated, without cutting the metal, to improve their appearance but such a treated surface does not constitute a finished surface as the term is used in machine-construction parlance. On the other hand, there are other surfaces on metal members which must be finished. That is, the metal must be cut off by some process or other to satisfy certain dimensions or to present a certain specified appearance. Thus, there are a number of different kinds of "finishes": chip, chip-and-file, mill, plane, rough turned, polish, scrap, and others. A surface which is to be finished must be so designated on the drawing that the machinist will understand what is required.

As to whether the finish specifications should be determined in the drawing room or the shop is a question worthy of some consideration. The proper answer to this question is determined to a large extent by the organization and personnel of the drafting and production departments in the place where the work is to be done. Unquestionably, if the draftsman is sufficiently familiar with machining operations to specify intelligently the finishes these specifications can be made most economically in the drawing room. On the other hand, if the draftsman is not familiar with machine-shop practice it is then better to merely specify on the drawing in general terms the kind of finish or the result desired. The conduct of the machining operations required is then left to the shop. This procedure permits the shop man to use the machine or method he deems most suitable for the work—but he must get the result.

As an example, holes may be specified as "drilled" whereas they might be more economically, and quite as satisfactorily, "punched." In this case the finish specification regarding these holes on the drawing would be incorrect. It is almost obvious that, where feasible, it is most economical to have all of the machining operations planned in the drafting room. Where this procedure is followed the shop operations can be completed with the expenditure of minimum time and effort. Frequently this result may be obtained most effectively by close co-operation between the shop and the drawing room. The draftsman should at all times work in close harmony with the chief mechanic, his equivalent, or the shop man. If he does this his drawings will reflect a balanced opinion of theory and practice.

The approved method of designating a finished surface is to use a modified "f" drawn across the line of the drawing representing the finished surface as depicted in Fig. 1. The finish symbol is the same as an inclined lower-case "f" except that it has a heavy black dot on its end. The cross line should be drawn transversely through the stem of the "f" adjacent and parallel to the line of the drawing representing the surface to be finished. Often one of the words enumerated in the list above (such as 'chip," "mill," "plane," etc, etc.) is necessarily used in combination with the finish mark to show just the character of the finish which is required.

Finish designations of other types are shown in Fig. 2. At A the finish required on the three surfaces of a keyway slot is designated by using a single symbol with three leaders radiating from it to the surfaces. At B is represented a finish symbol in which the transverse line intersects the line representing the surface to be finished. Finish marks of this type are considered undesirable

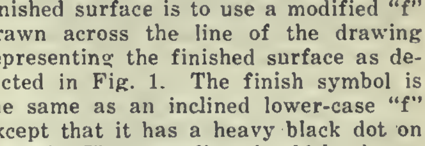


FIG. 1—TWO SURFACES TO BE FINISHED DESIGNATED BY FINISH MARKS.

in some drafting rooms because it is asserted they tend to confuse the outline of the object, and may not indicate definitely the surface to be finished. At C is cited a finish mark lying wholly outside of the outline of the object. The surface to which the character points is the one to be finished. By using different numbers and arrangements of the "hooks" on the symbol a code can be developed whereby finishes of the different characters may be specified graphically. However, experience has shown that it is, as a rule, undesirable to designate the different types of finishes by code symbols. Confusion usually results. The better plan is to designate each surface to be finished with a symbol and to then amplify the symbol with an explanatory note if necessary. The symbol at C was originated by Prof. Fellows. He suggests that a symbol like that at AB (Fig. 3) may be used where all of the surfaces between the two symbols are to be finished.

When a dimension is expressed decimally, as at A in Fig. 1, such specification ordinarily implies that the limiting

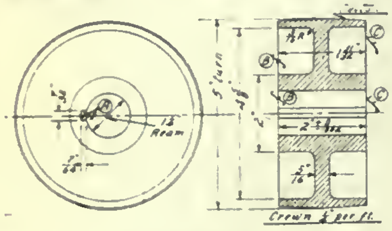


FIG. 2—ILLUSTRATING APPLICATION OF SYMBOLS OF DIFFERENT TYPES TO INDICATE FINISHED SURFACES.

surfaces are to be finished. Obviously, the specifying of a dimension with a decimal to the thousandths place would be inconsistent where the dimension was between unfinished surfaces.

When an object is to be finished all over, the information may be communicated by a notation "Finish all over" or "F.A.O." as portrayed in Figs. 4 and 5.

In specifying the finish for a taper hole which is machined to accomodate a taper pin the operations involved may be explained with a note thus: "Drill

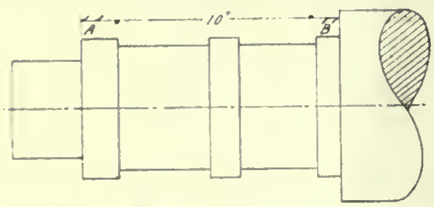


FIG. 3—ONE METHOD OF COMBINING FINISH MARKS WITH A DIMENSION LINE.

7/32. Ream for No. 4 Taper pin," as entered on Fig. 5.

Some special finish markings are defined in Fig. 6. At A "¼" Tap" means that the hole is to be drilled with a smaller drill (13/64 for a ¼" tap) and then a thread cut in its surface with a ¼" tap. A leader from the notation to the hole under consideration ties them together. The surface of a drilled hole is rough and it is impossible to drill accurately a hole to a specified dimension. Therefore, where the diameter of a hole must be of exact dimensions or where its surface must be smooth, the hole must be reamed after drilling. This may be specified "½" ream" as shown at B. Ordinary drilled holes are cited at C. Where a hole must be counterbored to accomodate the head of a cap screw or for some other reason this operation can be specified (D, Fig. 6) as "½" counterbore." The ½-inch specifies the diameter. The depth of the hole

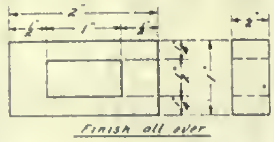


FIG. 4—OBJECT TO BE FINISHED "ALL OVER" OFTEN SPECIFIED AS "F.A.O."

must be given in a note or shown on an auxiliary view as in Fig. 6. The notation (E, Fig. 6) "3" turn" means that the outer surface is to be given no other finish than that provided when it is turned off in a lathe or mill. "Scrape" (F. Fig. 6) means that the surface specified is to be rendered as true as possible by hand scraping. Such a surface should be tested by rubbing on a surface plate covered with a very thin coating of prussian blue or other colored paste. The high spots thus disclosed are then scraped down. The testing with a surface plate and the scraping down of the high spots is continued until no high spots are apparent. "Polish" (G, Fig. 6) signifies that the surface identified by the leader is to be made bright and smooth, after machine finishing, by

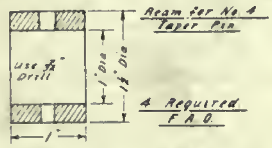


FIG. 5—"DRILL" AND "REAM FOR TAPER-PIN" AND "F.A.O." FINISH DESIGNATIONS.

cutting down with emery or some other abrasive, and then buffing.

The notation "core" (H, Fig. 7) denotes that the surface inside of the casting is to be left rough just as it comes from the foundry. The hole marked "bore" (I, Fig. 7) is to be cast smaller than specified and then bored to dimension in a lathe or boring machine. Note that limits are specified for the diameter of this hole. It may not be smaller than 1.250-inch nor larger than 1.260-inch. Thus a tolerance of 0.01-inch is allowed. The outside surface of this cylinder is to be ground (J,

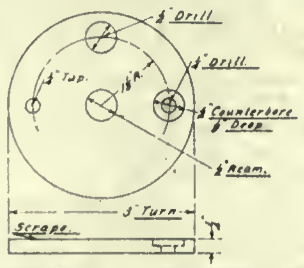
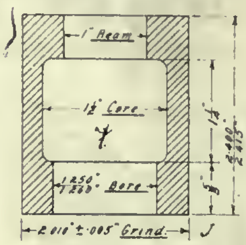


FIG. 6—SHOWING APPLICATIONS OF THE LEGENDS "DRILL," "TAP," "COUNTERBORE," "REAM," "TURN," "SCRAPE" AND "POLISH"

Fig. 7) in a grinding machine. A limit is also specified for this diameter. It may be either 0.005-inch smaller or 0.005-inch larger than 2.010-inch and pass inspection.

"Spot face" (K, Fig. 8) implies that the boss, ½-inch in diameter, extending above the end surface has been provided to permit of its being cut off about flush with the end surface, this to insure an even bearing for a nut or bolt head. The remainder of the end at K may be left rough. The legend "⅝-inch C'bore to surface" (L, Fig. 8) denotes that a circular spot ⅛-inch in diameter is to be faced off flat. That is, it is to be dressed until the roughness of the casting is obliterated and a true surface obtained. No dimension as to depth is necessary in this instance because this specification is used only where tolerance limits of considerable magnitude are permissible.



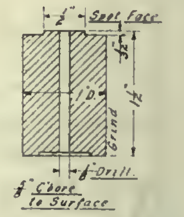


FIG. 7—CYLINDER TO BE "CORED," "BORED" AND "REAMED" INTERNALLY AT DIFFERENT LOCATIONS ALONG ITS LENGTH.

FIG. 8—ILLUSTRATING THE MEANING OF "SPOT FACE" AND "COUNTERBORE" TO SURFACE.

Some practical examples of the application of finish symbols will now be considered. In Fig. 9 the outside surfaces of the drill block are all to be finished as indicated, but the faces of the 90-deg. grooves remain unfinished. This drawing also illustrates the approved method of specifying the magnitude of an angle on a mechanical drawing. Figs. 10 and 11 showing respectively working drawings for a clamp and a shaft present practical applica-

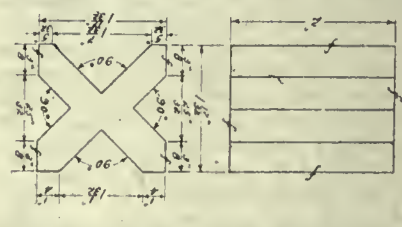


FIG. 9—DETAILS OF A DRILL BLOCK SHOWING HOW THE MAGNITUDE OF ANGLES IN DEGREES MAY BE SPECIFIED AND ALSO SHOWING APPROVED METHODS OF INDICATING FINISHES.

tions of some of the finish marks and specifications which have been discussed in preceding paragraphs. Both of these pictures represent practical working drawings rendered in accordance with the best modern practice. Note particularly on Fig. 11 how the limits and machine operations are specified. Also consider the method of dimensioning, the rendering of threads, construction of the arrow-heads, and the utilization of the sectional view at AA.

Conventional "breaks" can often be used to advantage in mechanical drawing to indicate more clearly the constructional character of some member shown on the sheet. Considerable ingenuity can be displayed in this regard by a draftsman. He may, by showing some member "broken" convey the necessary information about the construction of the piece which would, if the break were not shown, require several views for its complete definition. In Fig. 12 are exhibited the more important breaks used on drawings. Where a long thin member such as a pipe or rail or an I-beam is to be detailed it is unnecessary to draw a short length of the piece and then "break" a portion out of the center, using one of the conventional breaks shown in Fig. 12. The overall dimension given on the sheet will indicate the exact length required of the member.

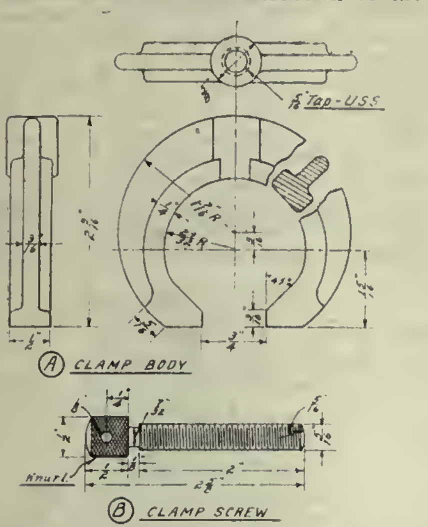


FIG. 10—WORKING DRAWING OF THE DETAILS OF A CLAMP. THIS ILLUSTRATES GOOD PRACTICE IN INDICATING FINISH, IN DIMENSIONING AND IN GENERAL RENDERING.

The language of lines in mechanical drawing is interpreted graphically by Fig. 13. The fact that mechanical drawings constitute a language universally understood by those familiar with engineering matters has been explained ni preceding sections. It has for many years been the practice to utilize, in rendering mechanical drawings, lines of different characters to represent different things or ideas. Many of the conventions thus adopted are universally applied, while others are employed but seldom. Obviously, it is a very bad and confusing practice to use on a drawing only two or three kinds of lines. When this is done the drawing does not appear complete and it is difficult of interpretation. The essential requirements of the lines of the different characters are three:

(1) They should be readily distinguishable from one another.

(2) They should be capable of being made easily.

(3) There should be considerable contrast between them to insure ready interpretation and good appearance.

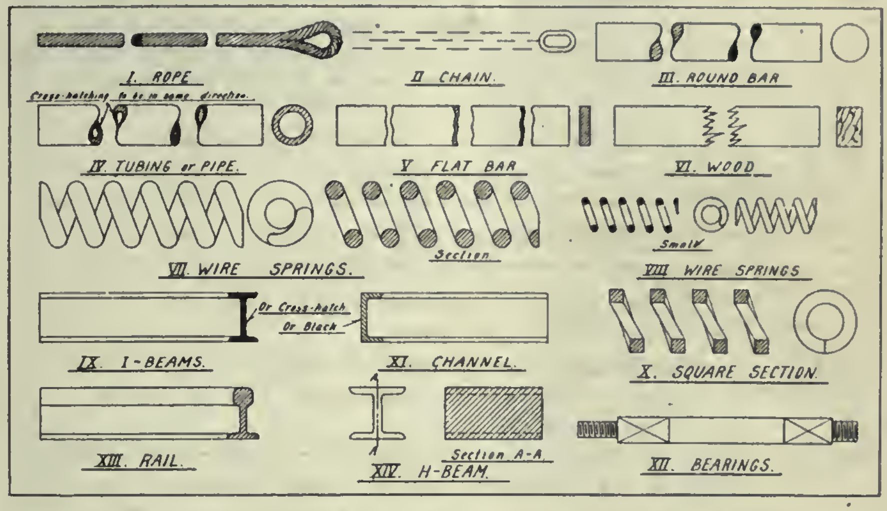


FIG. 12—SOME CONVENTIONAL "BREAKS" EMPLOYED IN MECHANICAL DRAWING.

The second requirement—that of ease of production—is of particular importance with the lines which are made most frequently. The symbols of the chart of Fig. 13 represent, it is believed, the very best practice. The lines of each of the types exhibited in Fig. 13 will now be considered individually. Practical applications are given in Fig. 14.

The visible outline (A, Figs. 13 and 14), sometimes called a boundary line, is used to indicate any visible edge, boundary or sharp break of a surface, which is invisible from the location from which the object which is shown in the drawing is viewed. It is in ordinary mechanical drawing to be made quite heavy—the heaviest line on the sheet with the exception of the border line—and it is to be continuous. It is made heavy to emphasize the contour of the object.

Invisible lines (B, Figs. 13 and 14) are used to show any edge or border of a surface when that edge or border is concealed from view. A dash line comprising relatively short dashes is used. The dashes may be from 1/8-inch to 3/16-inch long with a 1/32-inch open space between them. The invisible line should be somewhat lighter (thinner) than the outline to insure contrast. Whenever two lines consisting of dashes are drawn parallel and close together, the breaks between the dashes should be staggered. Where this is done the course of each broken dash line can be followed more readily by the eye.

Center lines (C, Figs. 13 and 14) are imaginary lines drawn through the centers of symmetrical views and are used as reference lines. The object of the drawing is, or certain parts thereof are, symmetrical around the center lines. In laying out a drawing or sketch usually the first step is to plot the center lines. They should be very light and composed of alternate dots and dashes. The dashes should be about ¾-inch long and the dots 1/32-inch long. The spaces between should be about 1/32-inch.

Dimension lines (D, Figs. 13 and 14) are the lines which identify the points between which dimensions are given. On mechanical working drawings on tracing cloth for blueprinting it is universally considered good practice to make dimension lines very fine unbroken black lines, except where an open space is left for the figures indicating the dimensions and the notations. On each end of a dimension line are arrow-heads or barbs. These should be distinctly and neatly made (Fig. 15-1 and 11). The sides of the arrow-head should spread slightly away from the dimension line, but not too

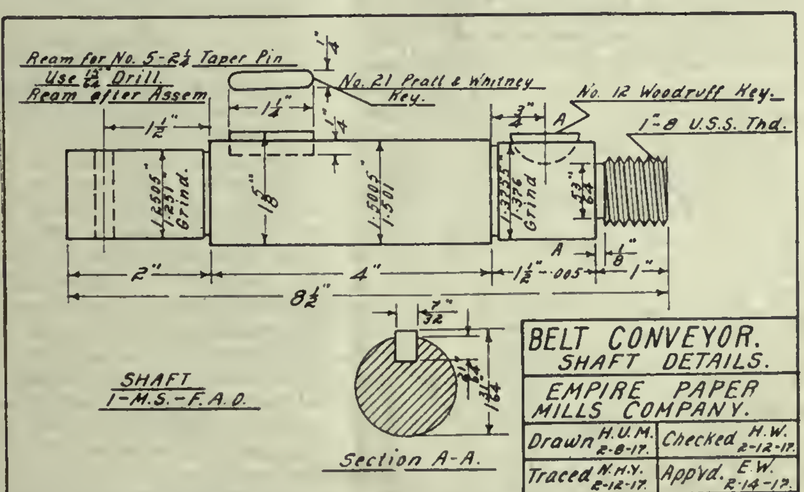


FIG. 11—WORKING DRAWING OF A CONVEYOR SHAFT ILLUSTRATING GOOD PRACTICE IN SPECIFYING LIMITS, IN INDICATING THREADS AND IN DIMENSIONING, NOTES, ARROWHEADS AND SECTIONING

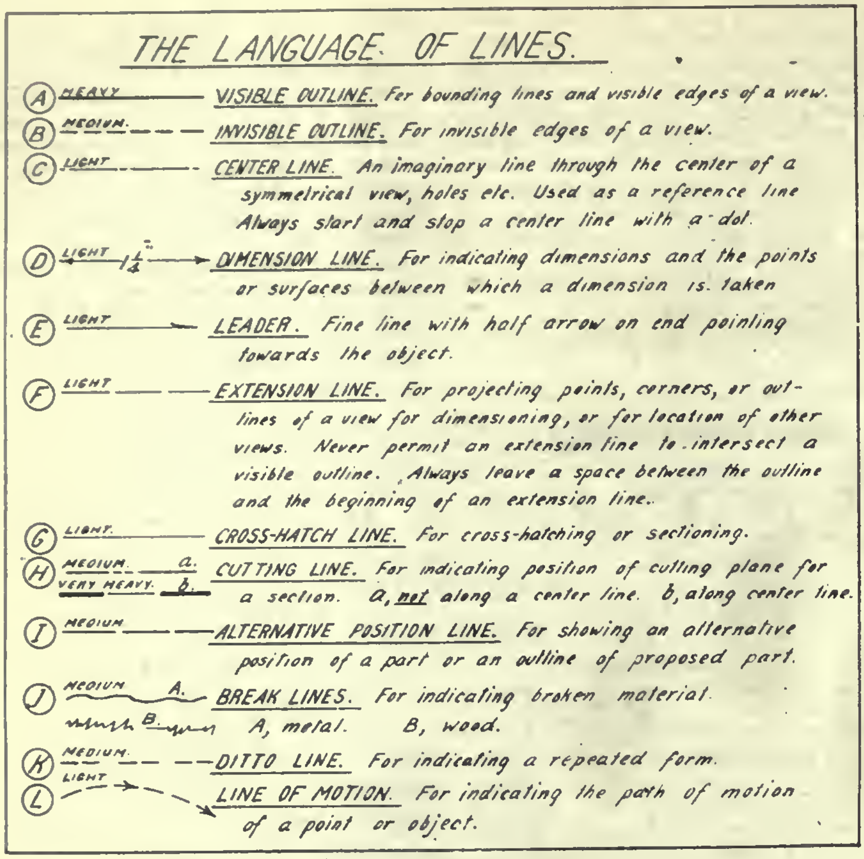


FIG. 13—A CHART SHOWING THE LANGUAGE OF LINES.

far. Only two strokes of a pen are necessary (III, Fig. 15) to make an arrow-head. Where drawings must be reproduced for zinc etching line cuts, a dotted dimension line gives more contrast and hence is more readily understood than a fine unbroken dimension line and is, therefore, frequently used for this purpose.

The leader (E. Figs. 13 and 14) is used to point to and designate some surface, hole, or other feature concerning which a notation or explanatory legend is necessary. It comprises a fine light line with a half arrow on one end. It may be either straight or curved. Where the draftsman is skillful, the leader line may be drawn free hand. Where he is not, it should be drawn mechanically with a ruling pen or compass. Note that the end next to the object should terminate in a half arrow (Fig. 15-IV) and not in a complete arrow-head as used on the end of a dimension line. The end adjacent to the note or legend need not have any distinguishing character on it.

The extension line (F, Figs 13 and 14) sometimes called a projection line, is an imaginary line used to project lines or points for dimensioning or to connect in the drawing the same surfaces or edges in different views. For example, an extension line may be used for projecting the position of a surface or edge in one view—possibly the side view—to the position or edge of that same surface in another view—perhaps the top view. Extension lines are fine lines made up of dashes ½ to ¾-inch long and with small spaces between them.

The cross-hatch line (G, Figs. 13 and 14) is used in shading cut surfaces. Ordinarily they are quite light and continuous, and drawn about 1/16-inch apart. However, they may, if some convention symbols have been adopted to indicate the sections of different materials, be dotted or of varying weights as occasion demands. The application of sectioning and section lines has been treated in some detail in a preceding article.

A cutting line (H-a, Figs. 13 and 14) sometimes called a cross-section line, is used when it is necessary to show where a section is taken through an object. That is, a cutting line may be drawn through the view to represent the edge of the cutting plane. This line should be of medium weight and should comprise long dashes separated at equidistant intervals by two short dashes or

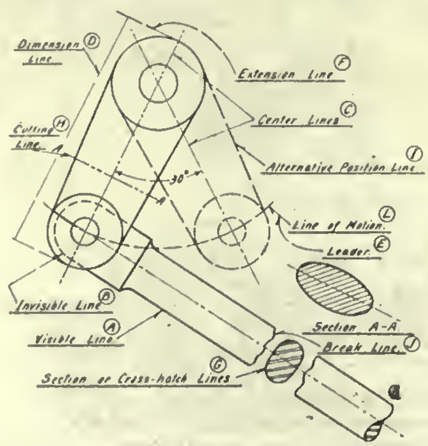


FIG. 14—ILLUSTRATING THE APPLICATION OF THE LINES OF DIFFERENT TYPES.

dots. Sometimes the alternate cutting line shown at b is employed when it is necessary to take a section along a center line. One heavy dash is drawn on the center line at the beginning and another at the end of the imaginary cutting plane. Different combinations of letters are used to designate the different sections which may be taken on a drawing. Thus in Fig. 14 at H the section is designated by the letters AA.

The alternate position line (I, Figs. 13 and 14) is used where it is necessary to show the second position of some other part that may interfere or for which clearance must be provided. This line

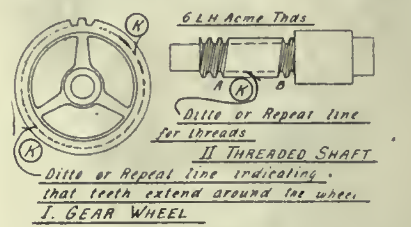


FIG. 14A—SHOWING APPLICATION OF THE DITTO OR REPEAT LINE.
(The form or contour of which the ditto line indicates a repetition should always be shown one or more times before the ditto line is used).

is made of medium weight and the dashes ¼-inch to ⅜-inch long.

The break line (J, Figs. 13 and 14) is used where a part of a view is broken away. This line is drawn very irregular to insure that its significance will be obvious. Refer also to Fig. 12.

The ditto line (K, Figs. 13 and 14A) is used for indicating a series of forms such as gear teeth and the like.

A line of motion (L, Figs. 13 and 14) is used to designate the path of the

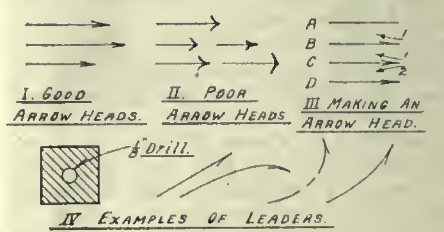


FIG. 15—EXAMPLES EXPLANATORY OF GOOD PRACTICE IN LINE SYMBOLS.

motion of a point. This symbol must be used often in machine drawings to insure the provision of proper clearance and proper arrangement. It comprises a series of very short dashes.

The lettering of a mechanical drawing is a feature the importance of which is often under-estimated. There is no other one thing which is so effective in giving tone and a business-like appearance to a drawing. A poorly-rendered drawing well lettered may present an attractive appearance. But on the other hand, no matter how well a drawing is made if it is poorly lettered it will look like a botched job. The lettering characters should be such that they may be read with minimum effort, which necessites a plain outline and uniform spacing, and they should be such that they can be made easily and rapidly. All lettering should be freehand.

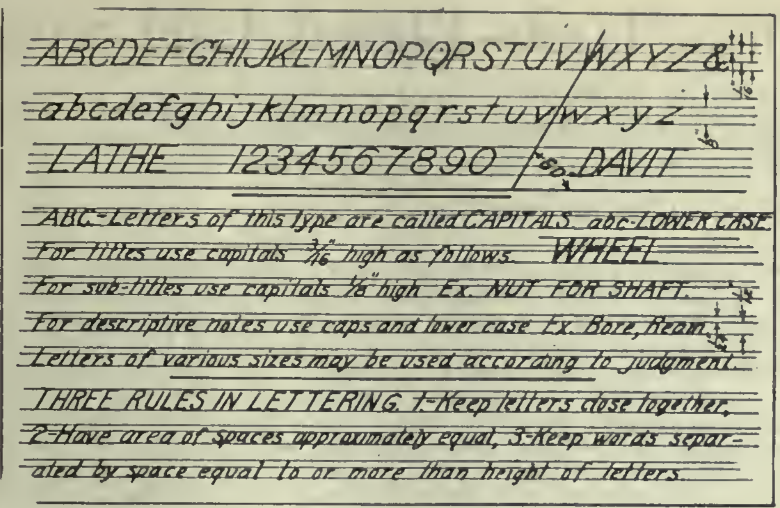


FIG. 16— LETTERING OF THE STYLE WHICH IS MOST SUITABLE AND ECONOMICAL FOR MECHANICAL AND ENGINEERING DRAWINGS.

To acquire the ability to letter, careful, faithful, and intelligent practice is necessary. It appears that there are few who cannot, with the expenditure of a reasonable amount of effort, develop the knack of lettering. Because an individual is a good writer does not mean anything one way or the other in so far as his capacity for lettering is concerned. Some good letterers are also good writers, but many are not.

As to the type of letter which should be adopted it is now usually conceded that the inclined Gothic or the so-called "Reinhardt" modification thereof is the preferable one for engineering drawing. This letter (Fig. 16) is simple and readily executed. Charles W. Reinhardt, who was for many years chief draftsman on the *Engineering News* made a study of lettering for engineering drawings and has prepared a very valuable brief treatise "Lettering for Engineers, Draftsmen, and Students," in which he described in detail the methods whereby one may become deft at the art of producing freehand letters. The simplicity of the system will be apparent from a consideration of Fig. 16. This type is used very extensively in engineering offices and machine drafting rooms.

In constructing freehand letters note that all are based on the oval and straight line. The slant of all the letters should be uniform and may be taken at some one angle, which may be one between 60 deg. and 75 deg. It is frequently desirable to adopt a 60-deg. slant because 60-deg. triangles are available for drawing pencil guide lines.

The size of the lettering to be used on any sheet should be determined by the purposes and character of the words which are to be used. For titles, capitals—frequently drawn vertical—about 3/16-inch high, constitute good practice. For sub-titles, letters ⅛-inch high may be employed. The notes and explanations should comprise only lower case letters. There are two reasons for this. First, it is much easier to read lower case letters than it is capitals. Second, the lower case letters can be made more rapidly. The bodies of the lower case letters should be equal to two-thirds the height of the capitals. In lettering pencil drawings a soft pencil—about 2H—should be used.

GERMANY'S SHORTAGE OF TUNGSTEN

By R. E.

Tungsten, a metal discovered by a Spaniard, is the principal ingredient in the manufacture of high-speed tool steel, and plays such an important part in the manufacture of projectiles, armour plates, gun boring, etc. Tungsten ore was found chiefly in the United States of America, Bolivia, Peru, Burma, Siam, China, Japan, Malaya, Australia, New Zealand, Spain, Portugal, England, and to a small extent in South Africa. Even before the war, the high-speed industry had secured an annual turnover of more than £300,000, and doubtless a comparatively small outly of £25,000 or £30,000 on the production of tungsten powder in this country previous to 1914 would have saved us a vast amount of money and much anxiety in the production of munitions. Thanks to the British Navy, Germany, which had been reaching out her hands to control the industry, was suffering from a shortage of tungsten amounting almost to famine. Owing to the greatly increased production of tungsten powder in the United States, where the output has risen during the war from 1,400 to 7,000 tons a year, and also in the British Empire, and again, in Siam, Britain was no longer dependent on Germany for any of the alloys used in the making of high-speed steel, while there are within the bounds of the British Empire ample resources to meet all our requirements if only the industry is properly fostered and encouraged.

AN ELECTRICALLY EQUIPPED SHIPYARD

By MARK MEREDITH.

During his tour of inspection of the shipbuilding areas of the North-East Coast, Lord Pirrie visited the Egis Yard. This yard, on which work was begun in November, and is now nearly completed, covers a site of nearly 16 acres, and is interesting from the fact that the whole of the plant is driven by electricity. The yard has four berths, each capable of building a ship 430 feet long by 56 ffeet beam, and of about 10,000 tons of deadweight. The principal buildings are erected on either side of the berths. On the south is a plater's shed 532 feet long by 100 feet broad, which contains all the most up-to-date electrically driven machinery for working the steel material. Direct gas-firing furnaces for frame and plates are installed.

The means of erecting the materials, when worked on to the slips, is provided by 20 steel derrick posts, 98 feet long, with 35 feet derricks, four on each side of each ship, with an independent electric winch capable of lifting 3 tons to each derrick. Six other portable electric winches are also provided for use when required. On the fitting-out quay 466 feet long, where the vessels will be fitted out after launching, is a 30-ton electrical driven travelling crane capable of lifting 30 tons at a radius of 54 feet, and 10 tons at a radius of 98 feet. The various stores and shops are all equipped with the latest and most efficiency machinery, and electrical power, lighting pneumatic piping, water pipes, are taken down between each berth, providing every facility for utilizing pneumatic power to the greatest possible extent. The plant is driven throughout by electricity supplied on the three-phase system.

CANADA'S SEA CONNECTIONS

By M. M.

In view of the progress now being made in Canada with the shipbuilding industry, more enterprise is being shown there than in any other part of the Empire. It is of interest to hear that important negotiations are taking place for a big development of shipping services between this country and the Dominion. Much, however, depends upon the settlement of the railway question which Sir Robert Borden has in hand, and with which it is understood he has made good headway since his visit to London in connection with the Imperial Conference. The Cunard Line is one of the companies vitally interested, as over a year ago it arrived at a working arrangement with the Canadian Northern Railway for an expansion of the country's overseas commerce, both on the Atlantic and the Pacific; and is naturally being held back pending an agreement between the various parties concerned. Another question to which it is said Sir Robt. Borden is to give prompt attention is the report of the Quebec Board of Trade for a prolongation of navigation on the St. Lawrence, between that port and the sea, throughout the year. If carried out, there is no doubt that the recommendations of the committee will make navigation on that river easier, but until an improvement is reflected in underwriters' statistics there can, be no possible reduction in premiums.

Operation of Machine Tools Effects Fuel Saving

Coal is Only of as Much Value as We Get Out of it—Proper Care and Operation of Machine Tools Means Lower Production Costs, and More Important Still, the Conserving of Considerable Fuel

By J. H. RODGERS, Associate Editor

WAR and waste demand conservation. Pre-eminent among the problems of the present day is the urgent need to save both food and fuel. Production has been so seriously interfered with that the shortage in many instances has approached a stage bordering on famine. Fortunately we in this country have not felt the full effects of warring conditions, but the experience of the past year in particular has been sufficiently vivid to impress us with the dire necessity of conserving to the utmost these two prime essentials of human maintenance. Last winter's coal scarcity is still fresh in the memory of most of us, and therefore, it behooves us to avoid, as far as possible, a repetition of such conditions. The saving of fuel is a problem of such magnitude that a comprehensive study of its many features would require the work of months or years to thoroughly grasp its fullest significance.

The fundamental value of coal is the potential power contained therein. With the production of the mines away below the industrial and domestic requirements, the problem becomes one of utilizing to the fullest extent every ounce of power contained in the quantity of coal that is now available. When the saving of fuel is mentioned we invariably turn our thoughts to the actual burning of the coal, as if this was the only place where the real objective could be attained. Undoubtedly the actual combustion of the coal for the production of heat units is the elementary factor that must be considered for a satisfactory solution of this problem, but it is by no means the only one. The burning of the coal is only the means to an end. In the achievement of this purpose many elements are obviously involved that are more or less important as fuel saving factors.

The heat from the burning coal must necessarily be transferred to various agents before the desired object is finally accomplished. The primary agent is the steam generated from the boiling water, this steam in turn transferring its power to the piston of an engine or the blades of a turbine, from which the power is again transmitted to the various machines by means of suitable mechanical equipment—or may be utilized in the operation of electric generators for power or lighting purposes.

Friction means power lost

With a little study it will be seen that the sole duty of the coal—apart from its actual heat giving value—is in overcoming the friction and resistance incidental to the operation of machinery, or processes, for manufacturing purposes. Very frequently the management of large industrial works look to the power plant staff for assistance in solving problems relating to fuel or power development. In the case of the latter it is mainly a question of ample and suitable equipment, but when the two extreme factors of maximum power and minimum consumption of coal is required the satisfactory solution is far more complex. In analyzing this fuel saving problem it might be well to look farther from the boiler and engine room than we are generally accustomed to do. Broadly speaking, the industrial conditions have greatly changed during the past few years. What would have been considered maximum production three years ago would be classed as poor practice at the present time. This has been brought about by the heavy demand for war material and the opportunity of manufacturers and machine tool builders to concentrate all their efforts in one direction, namely, the development of machinery and accessory equipment for the achievement of a specific object. In some respects the old meaning of competition has been virtually eliminated, as every tool builder is taxed to the utmost in supplying the present and future requirements, but this emulous contest is still continued in producing special tools to meet the ever increasing demands for greater rigidity in design and greater production capacity.

To meet the possibilities of the improved qualities of cutting tool steels, greater power is required to work these tools to their fullest capacity. In order that the additional power could be transmitted to the cutting tool it was necessary to change the proportions of the machines and strengthen many of the parts. In addition to the improvement made to standard equipment many special machines have been constructed for specific shell operations. One noticeable feature that predominates in munition making machinery, particularly on the rough turning and boring type is the greater bearing surfaces that have been given to the movable parts. The spindle bearings are much longer and diameters greatly increased, especially on those boring machines where the shell chuck is contained within the spindle. Greater length and width of ways are used on the carriage and cross slides, so that in many cases the frictional area of the movable parts have been more than doubled and likewise the weight of the different pieces. Therefore, before useful work can be performed on such machines sufficient power is required to overcome the friction of these parts. The amount of this resistance depends very largely on the ability of the operator.

Labor and Operating Efficiency

Under normal conditions selected labor would assist in maintaining the efficiency of the machine, as good mechanics will usually take a special interest in the care of the tools under their charge. With the class of labor now available, and under the system of piece work, little consideration is given to the machine itself, as every effort is spent in what the men think is along the lines of maximum production. It is quite safe to say that few machine operators stop to consider the relative connection between their work and this need of fuel conservation. Nevertheless, it is essential that each individual take a personal interest in this question. In the operation of machinery a large portion of the power transmitted is absorbed by the moving parts, so that the effective work is reduced to the extent of such resistance. It should be the duty of each operator to see that this machine friction is kept down to the lowest possible fraction. Time should be taken each day, and when necessary at intervals during the day, to thoroughly lubricate every portion of the machine where oil will assist its operation. This does not imply that all friction surfaces should be profusely treated with oil, but that sufficient should be used at all times to eliminate all unnecessary resistance to the moving parts. In many large manufacturing plants the lubrication of the transmission is under the direct supervision of a man appointed for the purpose, and in some instances this practice has been extended to the main bearings of the individual machines. However, unless the details of machine lubrication are taken care of by this method, the practice might still be detrimental to efficient machine operation.

Irrespective of any system that may be adopted for general lubrication, there must still be certain details that can only receive attention by the operator in charge. Chief among these is the lubrication of the slides on the carriage or turret heads. Generally the spindles or shaft bearings on machines are protected from flying dust or cuttings, but this is not the case when open slides are used. In order to maintain rigidity of the carriage and cross slide, it is imperative that the gibs be adjusted to avoid any semblance of lost motion. However, these slides must be free enough to move without too great an effort, so that continual care must be exercised in their maintenously aecets the accuracy of the slide entirely free of dust and cuttings, so that in time the fine particles work their way between the surfaces, increasing the power required to move the parts. To make these work easier many operators will slightly release the gib, thus adding to the space between the parts and likewise affecting the rigidity of the tool.

Others will flood the slides with oil after carelessly removing the exposed dust; this is probably worse practice than backing off the gib as the oil and grit act as a grinding compound that in time seriously affects the accuracy of the slide, without materially aiding its movements. Before applying oil to the parts that are exposed to dust or cuttings, the slides should be carefully wiped clean and just sufficient oil used to give a thin layer to the surface. In addition to this it would be good practice to thoroughly clean the ways several times a week with kerosene.

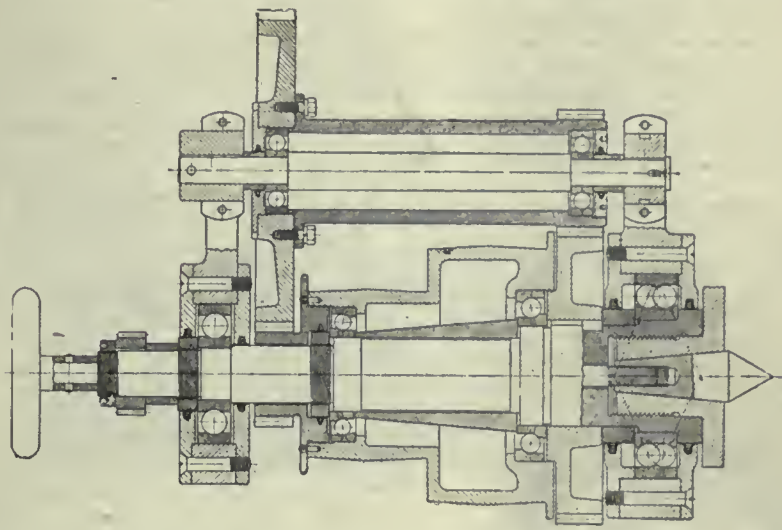
The writer has often experienced the effect of carriage lubrication in the manipulation of saddles on large lathes. The free movement of the carriage is often so gradually affected that an operator may not realize the effort he is putting forth in moving it along the ways. When the slides are dry or choked with fine dust, it frequently requires ten times the power to operate the carriage. This condition also applies to thrust bearings. It may be that the cylindrical portion of the bearing is well lubricated and free running when the machine is not operating under load, but with work in progress the friction of the thrust portion is excessive, owing to the absence of oil. This can be readily seen in the cross feed screw, as a detail under the direct control of the machine operator; very often a drop of oil between the thrust collar and its seat will remove over 50 per cent. of the resistance.

In connection with the saving of fuel these various mechanical details of machines may appear almost insignificant but in plants where hundreds of machines are in continual use, the power required to overcome this friction is no small matter, so that a more careful consideration of this feature might well serve as a basis for the reduced consumption of coal, and at the same time maintain the maximum efficiency of the various machine tools.

THE "DRAGON" BALL BEARING

The "Dragon" bearing is a new and distinctly different type of ball bearing which the Fafnir Bearing Company of New Britain, Conn., has recently begun to manufacture. This bearing involves new principles of design which make it much more efficient than the ordinary ball bearing for certain kinds of service. A large number of these bearings are already in use; and, in every instance, they have proved very efficient.

Although the accompanying cuts quite clearly illustrate the salient and distinctive principles involved, they may well be supplemented with a few words of description. To begin with, this bearing is a double row ball bearing, manufactured in standard single row widths, in each instance containing approximately double the number of balls of the corresponding single row bearing. This very advantageous feature in the construction of the Dragon bearing is made possible by the fact that the two rows of balls are staggered in relation to one another. Furthermore, this intersecting of the two rows of balls renders superfluous the use of a ball retainer, since the balls automatically space one another and travel around the race paths with a total absence of spinning.



COMPLETE BALL BEARING APPLICATION.

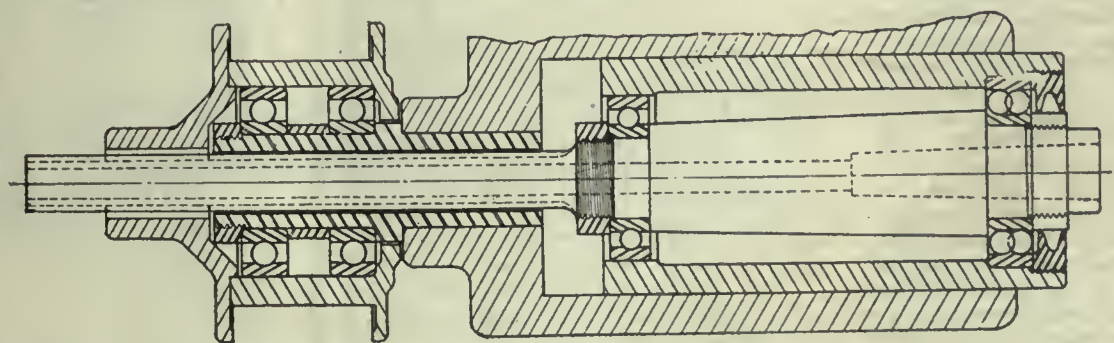
On account of the greater number of balls, the bearing will easily carry fully as much radial load as a single row radial bearing. Moreover, since it is an angular contact ball bearing, in which the load lines of the two rows of balls are mutually opposed, the Dragon bearing will carry, in addition to the aforementioned radial load, a tremendous amount of thrust load in either direction.

The significance of this important feature of the Dragon ball bearing will be even more thoroughly appreciated by the reader when he realizes that in all existing types of single row radio thrust bearings (which include all other types of angular contact bearings manufactured in standard single row widths) thrust load can be carried in one direction only, resulting in a constantly present danger that the bearing may be so mounted that the thrust load does not fall on the heavy side of the ring. A mistake of this kind in mounting would naturally be disastrous and would inevitably result in the summary destruction of the bearing itself and, very likely, of other parts of the mechanism. In regard to the Dragon ball bearing,

SECTIONAL ELEVATION.

however, it will plainly be seen that there is no possibility of such mishap, since the thrust capacity of this bearing is equal in both directions.

In addition to this the bearing is a self-contained unit and does not require a second bearing mounted with its thrust line opposed, in which event the efficiency of the entire installation depends upon the accuracy with which a

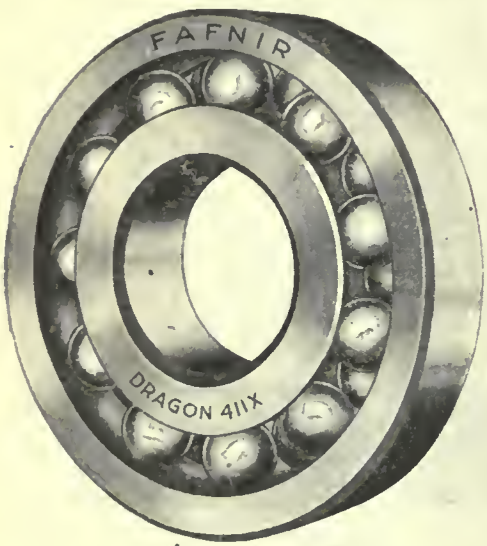


APPLICATIO NOF BALL BEARING TO DRILL SPINDLE.

delicate adjustment is made of the bearings endwise, in order to effect exactly the correct degree of ball contact, involving the elimination of end play without cramping the bearings. This condition, however, applies to all other kinds of angular contact bearings manufactured in standard single row widths and embraces all types of single row radio thrust bearings. These are considerations of primary importance, especially at the present time, since in many plants the men in the assembly departments are not skilled mechanics, and no matter how complete the directions for mounting, mistakes and extremely costly ones, too, will and do occur.

When Applicable

Coming to a discussion of the conditions under which the bearing is particularly applicable, it will be evident from the above statement that here is a ball bearing which, in every instance, is interchangeable with the corresponding standard single row radial bearing, but which, in addition to possessing



THE DRAGON BALL BEARING

equal capacity for carrying radial load, will take heavy end thrust load in either direction. Consequently, it will frequently be found highly advantageous and also economical, both in space and money, to install a ball bearing where hitherto it would have been customary to employ a single row radial bearing and a thrust bearing. For example, under conditions of service involving both radial load and heavy thrust load in either direction at extremely high speeds of rotation, the bearing will be found far more efficient than the combination of radial and thrust bearings. This is due to the fact that the effectiveness of a thrust ball bearing at very high speeds is seriously affected by the tendency of centrifugal force to cause each ball to travel on a tangent and leave the races. On the other hand, centrifugal force actually increases the efficiency of the Dragon type, since it causes the balls to be seated more firmly in the outer races, which tends to increase the thrust carrying capacity of the bearing. Moreover, at this juncture, it should not be overlooked that this bearing may also be utilized in place of an ordinary two-row angular contact ball bearing, performing the same work but occupying less space and being less expensive to buy.

Examples of Installations

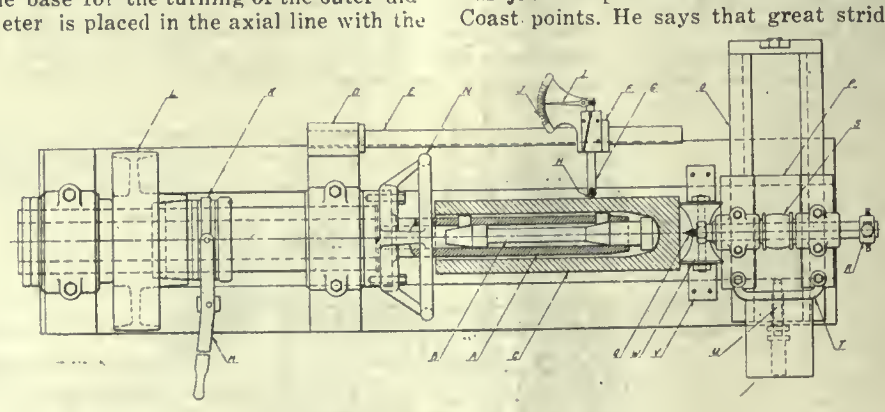
An application which is characteristic of the type of installation for which the Dragon ball bearing is exceptionally useful and efficient is to be had in a worm shaft mounting, a typical example of which is contained in the accompanying illustration. Here the bearing carries the radial load at one end of the shaft and, in addition, takes the heavy end thrust load involved in the transmission of power through the gears. Finally, it will be noted that a Dragon bearing is mounted to carry the drill thrust of the high speed drill spindle shown in the accompanying cut.

SHELL CENTERING MACHINE

ECCENTRICITY in the walls of shell forgings has always been a serious factor in the production of munitions. It is the exception rather than the rule to obtain a shell forging with absolutely uniform walls. The variation in the thickness between the thin and the thick side is sometimes so great that nothing can be done to utilize the forging. Fortunately the percentage of shells now rejected for this defect is considerably smaller than when this industry was in the incipient stages, the work now turned out by the presses being more accurate and the equipment more reliable. However, it is still practically impossible to produce shell forgings with concentric walls, so that care must be exercised in the primary centering operations to insure the turning of the shells to the specified diameter.

Owing to the bore of the shell offering the greatest obstacles to accurate machining it is invariably the practice to do the initial gauging from the interior surfaces. Whenever possible the center in the base for the turning of the outer diameter is placed in the axial line with the forged bore. This naturally throws any eccentricity upon the exterior surface. Various methods have been devised to determine whether this eccentricity is greater than permissible, the general practice being to gauge the wall before placing the shell on the centering arbor. The factor of time, however, is the chief consideration in the adoption of any device for this purpose.

The drawing herewith illustrates a machine produced by the Victoria Foundry Co. for the base centering on the 6-inch shells. Several features are incorporated in the design that tends to economy and rapidity of operation. The arbor A is secured to the nose of the spindle which is hollow for the use of a draw rod when same is required. The operating bolt B is so designed that the pressure on the end is sufficient to maintain the jaws against the bore of the shell while the center is being drilled. An extension D to the front bearing carries the small shaft E upon which slides the casting F, and at right angles to the traverse of F is located the sliding rod G, the front end carrying the small wheel H and the back end carrying a small pin for operating the pointer I, the needle of this finger indicating the eccentricity (magnified) on the graduated quadrant J. This is accomplished by the turning of the hand wheel N., the roller H bearing against the shell and the indicator showing the eccentricity of the forging. When the machine is in operation the gauging device can be swung clear of the shell. The spindle is revolved by means of the clutch operating in the loose pulley L On the right end of the lathe bed is the slide O that carries the saddle P upon which is mounted the centering spindle that carries the center Q. the forward motion of the center being obtained by the movement of the handle R: the lever o fthis is not shown. The carriage can be moved to the back of the slide by means of the handle T so that the shell may be removed from the arbor. To prevent the weight of the shell from resting on the end of the arbor when removing it from position, a roller W is provided, this roller being supported on a shaft resting in brackets placed on the bed of the machine.



SHELL CENTERING MACHINE

Victoria.—W. P. Hinton, vice-president and general manager of the G.T.P., has just completed a tour of the Pacific Coast points. He says that great strides have been made in shipbuilding in the coast since his last trip, and predicts that the renewal of the wooden shipbuilding industry at Victoria will be the making of the port industrially and commercially.

Tantiron; An Acid Resisting Ferro-Silicon Alloy

Acid-resisting Irons of Great Use in Industry—Replace Far More Expensive Metals and Give Equal or Better Service

THE manufacturing chemist and metallurgist are greatly restricted by the limitations of applicability of their apparatus. In many processes, the difficulty is not so much to obtain the raw materials as to find furnaces, containers, pipes, &c., that will bear the chemical and physical stress of the reactions, and to avoid the contamination of the products by the substances with which the reactions bring them into contact. For these reasons many a promising process never gets beyond the laboratory stage; hence, also the cry for substitutes of rare, expensive materials, as well as the natural distrust of them. The enhanced activity of certain chemical industries has much increased the demana for refractory materials and acid-resisting alloys. Experiments with acid-resisting iron alloys are not new, of course. Wollaston made a silicon-iron, and he may not have been the first. Engineers and electricians found silicon-iron very useful for special purposes, and many attempts were made to construct chemical plant of silicon-iron and other iron alloys. Tungsten, chromium and nickel were tried. But foundrymen seemed to be unable to make vessels even of moderate dimensions of such materials, and it was not till 1912 that an acid-resisting iron alloy of sufficient uniformity and strength for the engineer to deal with was put on the market, states "Engineering."

It was the tantiron of Mr. R. N. Lennox, made by the Lennox Foundry Company, of Glenville Grove, New Cross, S. E. Since then silicon-iron and other non-corrosive iron alloys have been brought out by several firms. Both the "duriron" of the Duriron Castings Company, of Drayton, Ohio, and the "ironac," of the

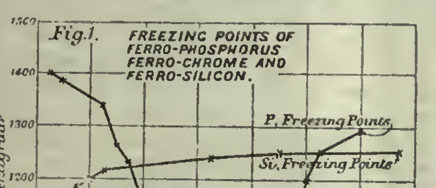


FIG. 1

Houghton Company, of London, are silicon-irons, like the mètillures of A. Jouve, one of the first in this field, and the Italian eleanites, which contain about 2 per cent. of nickel. The American rights for tantiron were, in 1913, taken over by the Bethlehem Foundry and Machine Company, Pennsylvania. "Ferrochrome" is supplied by the Electrometallurgical Company of Niagara Falls; the "feralun" is likewise an American product, and German activity in the field will not have ceased during the war; in addition to "neutraleisen" there are ferrochromes and ferro borons.

That Mr. Robert N. Lennox should have taken up the manufacture of apparatus for the concentration of strong acids was only natural. His father had made sulphuric acid in Glasgow in the days when heavy investments in platinum plant were indispensable for that purpose. When Mr. Lennox started a foundry on his own account, he had for a good many years conducted experimental engineering works of his own, and had, as assistant in the Royal Institution for nearly 25 years, taken his share in Sir James Dewar's low-temperature and high-pressure researches and in the manifold other investigations which are being carried on in the Royal Institution. Extensive well-equipped laboratories are a noteworthy feature of his works.

Properties

Tantiron—a fancy name—is a silicon-iron, containing about 15 per cent. of silicon. In appearance it is a silvery-white close-grained cast-iron, and has the general properties of a machinable cast-iron. One special brand of tantiron is very hard, and not machinable; another quality resists hydrochloric acid which the others do not. It melts at about 1,200 deg. C., can be cast, ground with carborundum, cut with the saw, drilled, screw-cut and tapped, &c. So far as chemical and mechanical corrosion is concerned, it is a superior iron and is used for cast vessels or in the shape of linings for those of steel or iron. It does not rust, except at the skin, and the rust is removed by pickling in diluted sulphuric acid or by grinding. The tantiron itself is not—or practically not—attacked by sulphuric, nitric, or acetic acids, concentrated or diluted, boiling or cold, and indeed not by most chemicals. One kind already mentioned—a more recent invention—also resists hydrochloric acid equally well. Carbonic

FIG. 2

acid attacks it slightly, but the corrosion is only about one-thousandth that of cast-iron. Alkalis corrode it about as much as they do cast-iron; chlorates and perchlorates do not corrode it, and it will resist chlorine gas up to a temperature of 105 deg. C. But sulphur dioxide corrodes tantiron badly. In view of this latter fact, the suitability of tantiron pans and basins for the concentration of sulphuric acid is rather surprising Large pans have been in use, however, we are informed, since 1912, and some 25,000 basins are actually in use in sulphuric acid works. There is some slight corrosion, of course, and there are breakages, partly due to the material, partly to improper treatment by unskilled labour, which causes many small and large accidents in these days of rapid plant erection and high-pressure activity. The maintenance cost of pans and basins is about 2½d. or 3d. per ton of acid concentrated. After boiling 100 grams of the alloy for 17 hours, 10 per cent. sulphuric acid was found to have dissolved 0.13 gram of tantiron, 25 per cent. nitric acid, 0.25 gram, and 30 per cent. hydrochloric acid, .16 gram.

Limitations

The terms "non-corrodible and acid-resisting iron," are misleading, as all such general terms are. Every chemist knows that he must not allow metals to glow in his platinum crucible, as they would form fusible platinum alloys, and that caustic alkalis and certain alkali salts, and even the sooty flame of the gas burner, will ruin his crucible. Tantiron also has its peculiar weaknesses. It resists hot sulphuric acid much better than cold acid ,and many instances of attack are so far inexplicable. In one case, a tantiron tower containing vapours from boiling sulphuric acid showed defects in the top sections, without any attacks on the bottom sections. The top sections were replaced several times; the bottom sections, which had

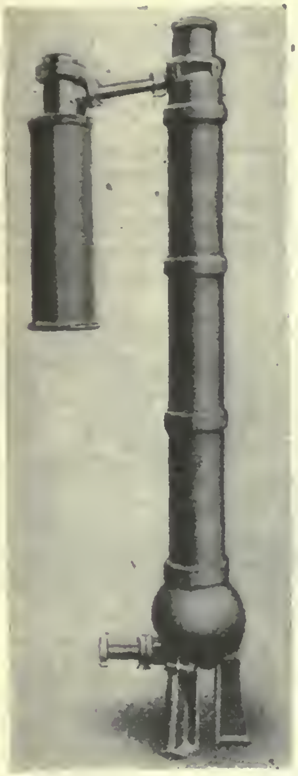


FIG. 3—DENITRATING TOWER

been in use for eighteen months, were taken out and inserted in the top, when they were attacked within a fortnight; yet temperature determinations at different points of the tower never showed differences exceeding 5 deg. C. In other cases, sulphuric acid, on being carefully freed from arsenic by sulphuretted hydrogen, attacked the tantiron nearly three times as quickly as the original acid. But the amount of attack is, of course, exceedingly small. A tantiron vessel weighing 4,950 grams, had 600 tons of sulphuric acid passed through it during concentration with a total loss of weight of 12 gram. The attack is mainly on the surface of the skin, which should, therefore, be removed when corrosion tests are conducted.

Though the iron carbide seems chiefly to be attacked, the corrosion is, apparently, uniform; under the microscope, acid-corroded tantiron keeps its smooth surface, while cast-iron shows irregular corrosion. Mr. Lennox prefers to have no carbon in the iron at all. His raw materials are cast-iron, scrap, and old tantiron, and further ferro-silicon. The latter is obtained with about 12 per cent. silicon from Middlesbrough, and in a 50 per cent. grade from Norway. The average composition of tantiron is in per cent.: silicon, 14 per cent. or 15 per cent.; total, carbon, from 0.20 per cent. to 0.60 per cent.; manganese, 0.25 per cent. to 0.35 per cent.; phosphorus, 0.16 per cent. to 0.20 per cent.; sulphur, under 0.05 per cent. The three kinds mentioned, machinable tantiron, hard tantiron and tantiron for hydrochloric acid, differ little in composition, but the small fractions of additional constituents are very important. To study their influence, ingots are poured from furnace charges of 1 ton, to which additions are made in very small increments; the ingots are then tested chemically and mechanically. The sulphur and manganese, in their percentages, seem to be of no consequence. The phosphorus is deleterious, mainly probably because it is not uniformly distributed, but concentrated in spots. As phosphorus is added to iron, the freezing point is first lowered, and then, when 10 per cent. of phosphorus is exceeded, rises again,, but the cooling curves are not regular, whilst the freezing point curves of silicon-iron and chrome-iron show a very slow, but steady rise with increasing percentages of those elements. (See Fig. 1.) Impact tests are made on ¾-in. square bars, which are not notched; they break, e.g., under stresses of from 8 ft.-lb. to 10 ft.-lb., against 12 ft.-lb. to 14 ft.-lb. in the case of cast-iron. On the whole, the strength of tantiron is about 25 per cent. smaller than that of cast-iron. The following is a summary of the comparative properties of tantiron and cast-iron (the latter figures in brackets): Density 6.8 to 7.0 (7.3); tensile strength, 6 to 7 (9 to 10) tons per sq. in.; transverse strength, bars of 12 in. by 1 in, 1,600 lb. (2,500 lb.); crushing strength per inch cube, 34 (40 tons); melting point, 1,200 (1,150) deg. C.; hardness, 1.6 (1); heat conductivity, 8 (10); electrical resistance,

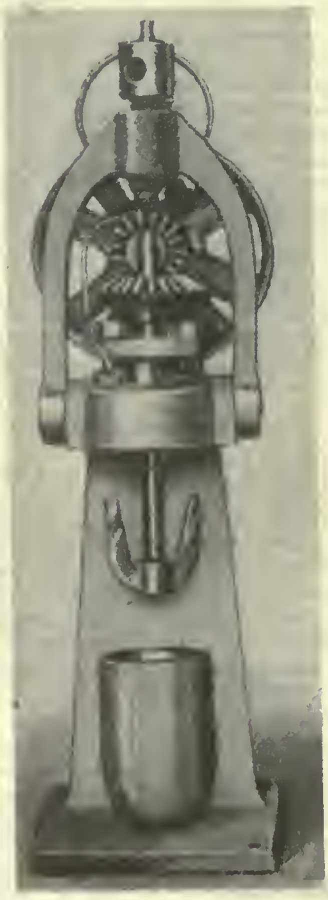


FIG. 4—AUTOCLAVE CUP OPEN ON STAND

10 (8); resistance to corrosion, 1,000 (1); contraction allowance in casting, 3-16 (⅛) in. per ft. As regards other properties, also of other materials, the comparative order for iron, tantiron, lead,

FIG. 5—AUTOCLAVE CUP CLOSED

quartz, stoneware is: Transmission of heat, 230, 215, 115, 28, 20; hardness, 24, 35, 1, 52, 32; density, 7.3, 7, 11.3, 2.6, 2.0; melting point, 1,150, 1,200, 335, 1,900, 1,800 deg. C.

Limits of Corrosion

With respect to corrosion by chemicals, there is generally a first attack, followed by relative immunity under continued exposure. The following figures indicate the percentage losses of tantiron after boiling for 24, 48, 72 hours; the greater action during the first 24 hours is largely due to the already-mentioned skin effect, the outer surface having been changed by contact with the sand in which the tantiron is cast; this skin is removed in the foundry, as we stated.

	First 24 hrs.	Second 24 hrs.	Third 24 hrs.
Sulphuric acid, 98 per cent.	.10	.02	.02
Sulphuric acid, 30 per cent.	.07	.00	.00
Nitric acid, 1.4	.03	.01	.00
Nitric acid, 1.1	.01	.00	.00
Acetic acid, 60 per cent.....	.03	.01	.00
Chromic acid, 10 per cent...	.07	.00	.00
Tartaric acid, 25 per cent...	.05	.03	.03
Iodine (sat. sol.)	.00	.00	.00
Bromine water (sat.)	.01	.01	.00
Bleaching powder (sat. sol.).	.04	.01	.01
Copper sulphate (acid sol.)..	.00	.00	.00
Copper sulphate (alkaline)...	.00	.00	.00
Ferric sulphate (sol.)	.06	.00	.00
Zinc chloride, 30 per cent...	.03	.00	.00
Ammonium chloride sol.	.05	.02	.01
Fused sulphur	.06	.01	.00
Fused nitrate of ammonia ...	.00	.	.00

To meet the peculiarities of the material, it is desirable that designers of parts to be made in tantiron should bear the following rules in mind: large flat surfaces should be avoided, corners be

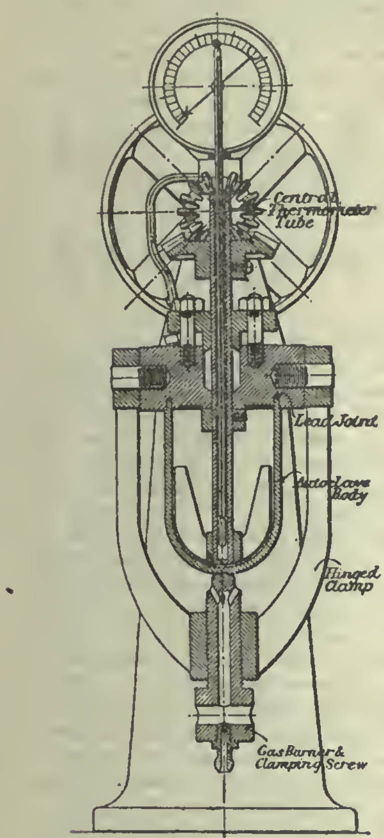


FIG. 6—SECTION THROUGH AUTOCLAVE

rounded; slots be used by preference to bolt holes; facing strips be narrow and of ample height; the effects of expansion and contraction should be well-considered; coring and moulding be made easy, by preference without the use of chaplets to support cores. Among the chief products now made wholly or partly of tantiron, are: acid pans, basins, stills, bleachers, denitrating towers, autoclaves, condensers, pumps, stop cocks, valves, pipes and fittings, electrodes, &c. Frequently a tantiron lining will suffice to prevent either chemical or mechanical erosion. The largest tantiron casting so far constructed weighed 7½ tons.

Moulding

The greatest care is bestowed upon clean moulding, which is mostly done by women, and use is made of rotating strickles in preparing the moulds for parts of circular section. For lining pipes with tantiron, the pipe must be suspended vertically by a flange with the core in proper position, the pipe to be lined being weighted below; if the liquid tantiron were poured into a horizontal pipe, the pipe would curve. This practice is generally adopted for lining iron or steel, wherever possible, and the part to be lined is well dried, but not pre-heated. The adhesion between the iron and the tantiron is said to be good, fusion taking place between the surfaces; the adhesion is tested with the aid of paraffin oil. The lining may have a thickness from ¼ in. up to 1¼ in. and more. The subsequent finishing of the product is largely done with the aid of carborundum wheels and grinders. It is rather curious that the fine tantiron particles torn off by the tools do not spark; there is only a glow. Drills, saws and planers are also used.

The basins for the heating and concentration of sulphuric are mostly of the plain porcelain dish style, but are provided both with a lip and an arc-shaped baffle (not shown); they are supplied also in the Webb and Dyson styles (Fig. 2). The basins are arranged in cascade, so that the hot acid drips from the lips of one basin into the one next below, and the baffle prevents the acid from streaming right over the basins to the lip. Provision for more efficient circulation and stirring of the acid in the basin is made in the "Mackenzie field tube evaporator basins," also supplied by Mr. Lennox; this style has calix shape, being a tube opening out into a basin; a "field" tube fits concentrically into the cylindrical portion and promotes active circulation. Other basins are provided with covers and necks, and made corrugated, and they serve generally also for the concentration of corrosive liquids, such as zinc chloride, lead nitrate, &c.

Concentration of Nitric Acid

The concentration of nitric acid requires more varied apparatus, which have successfully been made of stoneware in the past few decades. When the war broke out, the stoneware works of this country were not able to deal with the demands, and tantiron vessels, which can be made in a few days, whilst good stoneware requires months, were largely adopted. Valentiner plants, comprising a still, condenser and coils, built up of pipes and return bends flanged together, all of tantiron, are now made. The denitrating tower illustrated in Fig. 3 is an interesting novelty. The spent acid of nitroglycerin works consists of diluted sulphuric acid, which has to be concentrated again, and some nitric acid, which is to be regained by distillation. There may also be small globules of oily nitroglycerin which might coalesce if the evaporation were carried on in pans. The tower, 15 ft. high, is built up of socket pipes, 14 in. diameter, and is packed with quartz fragments; the acid enters at the top and steam at the bottom, and the nitric acid and vapours condense in the cylinder by the side of the tower. Nitric-acid stills are also used for the distillation of acetic acid. The autoclaves for making ammonium nitrate from cyanamide at a temperature of 120 deg. C. and a pressure of about 2 atmospheres, resemble one

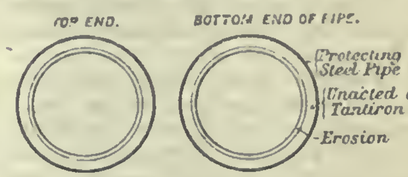


FIG. 7—EROSION OF TANTIRON PIPES IN SERVICE

style of nitric-acid retorts. The outer vessel is a jacket of cast iron, the inner vessel of tantiron forms the saturator; the height is 8½ ft., and the diameter 4½ ft., e.g.

The autoclave illustrated in Figs. 4, 5 and 6 is a clever compact laboratory apparatus, whose utility and handiness will appeal to every chemist. The ordinary autoclave has to be screwed up tightly and unscrewed again each time. In this Lennox autoclave the parts are clamped and unclamped by the use of one spanner, and everything, crucible or cup, stirrer, pressure gauge, burner, is ready for use. In Fig. 4, the cup is seen on its stand open, and the stirrup clamp is turned up. When the cup of tantiron is lifted, and the clamp turned down, the cup is pressed against the lead joint in the cover (Figs. 5 and 6), and the autoclave is sealed; the bolt passing through the clamp, by means of which the autoclave is tightened up, also serves as the gas burner, and the axial stem of the stirrer is hollow to receive a thermometer; the stirrer is actuated by an electric motor.

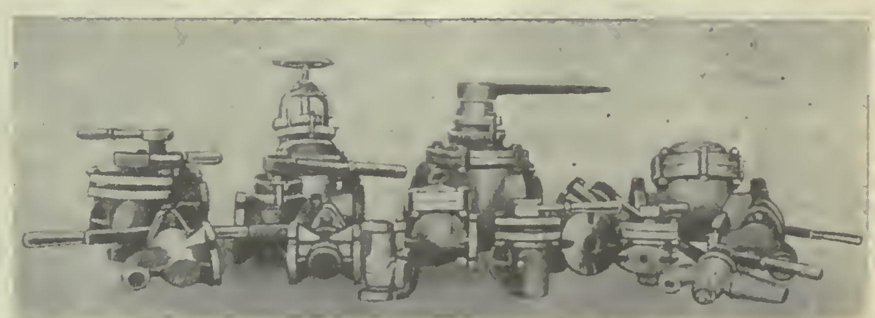


FIG. 8—ACID PROOF VALVES AND FITTINGS

Acid eggs, apparatus for forcing up corrosive liquids with the aid of compressed air, are made of two tantiron cups, joined by their top flanges so as to form a horisontal cylinder with spherical ends and one common flange on the vertical middle plane; they are provided with acid inlet and outlet valves and an air pipe, and are supplied in large sizes. The pumps of the works, reciprocating and centrifugal, do not differ much in appearance from ordinary pumps; the barrels and impellers and pipes are made of tantiron or lined with it. As these parts of hard tantiron cannot be machined or repaired, it is recommended to keep spare parts ready for cases of accident. Centrifugal pumps are supplied for lifting 6,000 gals. of acid or corrosive mine water, &c., per hour, against a head of 50 ft., running at 1,600 r.p.m. Slime pumps, e.g., for conveying the crushed quartz in gold mines, are likewise made of tantiron, to obviate the heavy erosion of the pipes by the gritty quartz particles. For the same reason, tantiron-lined steel pipes are used in the Rand mines, South Africa, for the sand-filling plant When the pillars left in the galleries below are to be removed, the galleries have to be refilled with the finely crushed quartz from the vast white waste mounds which form a conspicuous feature of the district. The spoil is flushed down the pipes with water. The first pipes used, steel pipes, were ruined by 6,000 tons of sand; porcelain-lined pipes were then tried, which could stand up to 50,000 tons; the tantiron pipes, introduced four years ago, are still doing duty, and their life capacity is estimated at 500,000 tons. The 500 ft. of 5-in. pipes put in were delivered in sections of 7 ft. Fig. 7 illustrates the erosion they had undergone by the passage of 106,000 tons of quartz sand under a head of 500 ft. In each case the outer ring represents the steel pipe, the second, intermediate ring, the tantiron remaining intact, and the inner ring the eroded thickness. The erosion is greater at the top, where the sand strikes the pipe than at the bottom, and is not the same in all sections, probably owing to peculiarities of their positions. Similarly-lined steel pipes and tantiron pipes, up to 2 ft. in diam., are in use for ash ejectors, especially on board ship, where heavy erosion and corrosion by the caustic ashes and the sea water have to be guarded against.

In stop cocks and valves of tantiron corrosion by acid sodium bisulphate (the acid cake residue of the distillation of nitric acid from salt and sulphuric acid), erosion by grit, rusting and sticking are the chief sources of trouble to be met. Here, again, tantiron competes with lead and stoneware, and its advantages lie in greater strength and indifference to high temperatures and frost. Fig. 8 shows types of cocks up to 4 in. in internal diam.; a groove is made in the centre of the cock and charged with a greasy preparation of ceresin, vaseline, black lead, and asbestos, which is pressed into the groove by means of a screw. A great variety of cocks, valves, T-pieces, straight and bent socketed pipes, provided with threads, are made in tantiron.

Specialties

Of other specialties, we mention the corrosive-vapour drying and baking ovens, the flat doors and walls of which are lined with sheets of tantiron, which are screwed on. Tantiron can be rolled at about 700 deg. C., but is brittle then. Another specialty is the tantiron electrode for cyanide baths (silver and gold), and also copper baths, &c., replacing iron and other alloy electrodes, which are not insoluble, and very objectionable on this account, or more expensive than tantiron. For the same reason, steel-mixing mills for the manufacture of manganates, the balls and stirrers of other mills, and many apparatus used in the acid and dye and other chemical industries, are made of tantiron.

Foundry work had been carried on in the buildings which Mr. Lennox now occupies for over 100 years. There are 2½ acres under roof, and about 200 people, including 50 women, are now employed. The work of the women, who have all been trained at the works, gives complete satisfaction; excepting in the pouring department, in which men alone are employed, they work in all the departments, in the laboratories, moulding pits and machine shops, as well as in the office, but are under the special control of a lady on the staff, who also looks after their little privileges as to tea and rest intervals, their starting work 10 minutes after the men, and leaving before them, &c. When husband and wife are both in the works, they are not attached to the same department.

Like every manufactured article, tantiron is constantly being improved, and does not claim to have reached final perfection. Acid-resisting materials must possess various properties which are not easily combined, and possibly not capable of combination. A compromise has to be accepted.

FLINT AND TINDER

By A. L. HAAS

In the account given of the flint knapping industry of Brandon, Suffolk, England, on page 225, August issue, there is a serious misconception.

The industry survived not upon commercial merit so much as the production of spurious pre-historic flint implements. Nearly every museum displaying flint arrow heads and other products of Neolitric man shows also spurious modern specimens of Brandon handiwork.

While matches are short over here at present they are not unobtainable and the writer has yet to learn that the flint and tinder of our ancestors is being used. The misconception evident is that the so-called flint in the mechanical lighter, whether tinder or petrol, is knapped flint of natural origin.

The substance used is an artificial product, a side issue in the making of the substances with which incandescent gas mantles are impregnated.

Actually, it is ferro-cerium and is in every respect superior to the natural flint stone in its sparking quality in conjunction wth hardened steel. The flint knapper of Brandon will doubtless still find a market for his wares. the credulous are numerous and short of the advice of an expert. It is well to be wary of pre-historic flint implements offered in many places to the tourist in search of trophies. Actually there is reason to believe that the only flints made to-day from natural stone are for export to where the heathen in his darkness bows down to wood and stone, while the lucifer match has penetrated almost the entire globe. The flint lock musket was the last real use to which natural flints prepared by knapping were put and that is many scores of years ago.

ST. LAWRENCE NAVIGATION EXTENSIONS

By D. I.

During the past decade, interesting and, as results have shown, important experiments have been carried out by the Quebec Board of Trade and others on behalf of the Canadian Government, with a view to ascertaining to what extent the navigation season of the St. Lawrence, which officially opens about the beginning of May and closes towards the end of November, is capable of prolongation. Those who took part in the inquiry are, definitely of opinion that ships may run between Quebec and the sea at all times of the year, and the Dominion Marine Department is now being urged to provide the additional safeguards that are considered necessary, such as sheltered storm centres, buoys and wireless stations. By this means it is believed regular cargo steamship services could be established between Quebec and the United Kingdom all year round. The employment of powerful ice-breakers would also be essential in lower reaches of the river. A board of marine underwriters for Canada on the lines of Lloyd's is about established at Montreal. It will among other things provide for a system of correspondents all over the world and supply early and accurate information of wrecks and casualties with special reference, however, to conditions on the St. Lawrence.

VALUE OF SCRAP IRON

By T. H.

In view of the increasing demand from the steel mills of the country for scrap iron, which demand is said to far exceed the supply, an appeal has been made for a special effort to save all such material. Before the trunk railways of the country were taken over by the Government, the railways were the most important contributors to material of this class used at mills. In many instances it could be delivered cheaply by the railroads themselves, and they have good facilities for its collection. It is said that if all the available iron and steel scrap in the country were marketed there would be no shortage of steel at the mills. Its collection has apparently been somewhat neglected since the Government assumed contro of the railroads, but there is no logical reason why such economy should not be practised under Government administration.

Cheap Labor Was Not Very Cheap in This Case

Locating a Factory in a Small Town to Secure Cheap Land and Low Labor Cost—Many Other Things Entered to Make It Certain That the Cheap Location Was a Very Expensive One

By T. H. FENNER, Associate Editor.

WHEN a manufacturing company, with a well established business in one section of the country, or in another country, wishes for the purpose of extending their business to establish a branch establishment in some district far removed from the head office, they often fall into some grave mistakes in their choice of a location.

A great many firms are content to locate in some well-defined manufacturing district in the midst of a considerable population and in so doing accept the accompanying penalties of high land prices, high taxes, and a wage scale governed by prevailing conditions. To offset these conditions, they have the advantages usually associated with an established industrial locality, these being plentiful rail and water shipping facilities, ample labor supply, and a large stock of general merchandise such as is always required in a manufacturing plant immediately available through the medium of numbers of competing supply houses close at hand. If any particular piece of material for a hurry up repair is required it is usually merely a matter of a telephone message to one or several warehouses in the immediate neighborhood to secure the required article in short time. Being in the centre of things, as it were, it is an easy matter for the purchasing agent to keep in touch with the various markets and the staff generally through the usual daily meetings and intercourse with others in the same line are kept up-to-date and on their toes. The labor turnover will be governed by the conditions prevailing in the factory, but whether it is large or small, the supply will be always on hand. This may not be true in abnormal times such as the last four years, but it is correct in normal times.

Other Ways of Locating

There are other concerns who send their representatives abroad through the highways and byways of the land seeking for some sort of a manufacturing Eden. They are looking for a spot which shall offer all the ideal conditions for an industry without a drawback. They want a situation on the main lines of three or four railways with water transportation also convenient, the town to donate the land for the building, exempt them from taxation for any period not exceeding 99 years, guarantee cheap labor, and instal a fire station at the front gate to reduce the company's insurance rates. Needless to say, this location has never yet been found and probably never will. However, there are many small rural municipalities who hold out inducements that appear to make the planting of an industry in their midst a good thing for the industry. In many cases it turns out all right, in others it does not. The usual drawing cards are those already mentioned, that is, low-priced land, exemption from taxation, and cheap labor. These conditions coupled with shipping facilities are big inducements to any firm but they should not be the deciding factors.

The Case of Two Shops

There are several conditions connected with a location which though not very evident when a location is being decided on are very evident after the factory is built. The writer has in mind two concrete examples which will illustrate what is meant. Though both located in the same place, they afford two distinct examples. The town in question is in a country district, but only 30 miles from a large manufacturing centre. One of the factories employs nearly all female help, while the other is dependent chiefly on male labor. Both firms received the usual inducements to locate and large sums were expended in building thoroughly up-to-date factories, well equipped both for production and the comfort of the employees.

The first factory had been located in the neighboring manufacturing town and the necessity of extending the plant had determined the executive to move away from the city. The whole of the foremen and executive staff, also the majority of the clerical staff, as well as some of the older hands, were moved out at the firm's expense to the new habitat, their personal effects, furniture, etc., being included. A large portion of the machinery was also moved, and it can be safely said that the expense of the moving of material, etc., would have gone some distance towards the paying of the difference in land values between the outskirts of the city and the rural district selected. In any case, the moving was finally accomplished and the factory started up. Right away the labor problem obtruded itself. Labor was certainly cheap in so far as the actual money paid out was concerned, but taking into account the return received on the money, labor was dear. The population the labor was drawn from was chiefly agricultural and densely ignorant of mechanics. Furthermore, never having been used to work regular hours for regular wages, they were inclined after receiving a week's pay to lay off until the money was spent when they would work for another week. This, of course, did not apply to every worker, but to enough of them to make their presence, or rather absence, felt. Some of the foremen who had moved out from the city became dissatisfied with the simple life and went back to the bright lights. Their leaving opened up another trouble. To induce the right kind of man to come out he had to be paid about 10% more than he would have received in the city. The company would naturally prefer to have married men take positions with them as they would be likely to stay. The right kind of man would make enquiries round about educational facilities for his children and finding these practically non-existent would decide against coming.

And More Yet to Come

This was all very discouraging, but there was more to come. Some of the men who were capable and intelligent and learned to be fair operators soon discovered they could get work in the city at better wages and off they would go. The result of all these conditions is that a factory equipped with very expensive machinery and extensive buildings for large production has never approached nearer than 30% of the capacity designed for, and furthermore its cost of production is higher than that of any factory owned by the same firm notwithstanding the lower wages paid.

The experience of the second factory compares closely with this. They were a United States firm establishing a Canadian factory with entirely new equipments. The executive staff only was sent from the States, the intention being to train up foremen locally. The same trouble was experienced. The local material could not respond to the opportunities and men had to be sent from the States. These men came more or less under compulsion and with a feeling that they were being side tracked, a feeling not without justification. Any man capable of filling a responsible position who is placed in one of these outlying factories knows that he is liable to stay there indefinitely as the difficulty of getting the right kind of man to move from a factory situated in a more

(Continued on page 487)

FROM THE MEN WHO PRODUCE

Methods, Machining Devices, Systems and Suggestions From Shop And Drafting Room

MANUFACTURING THE HILL HOLD BACK DOG

By ROBERT MAWSON

EVERY machinist is familiar with the method used of holding a piece of work which is only carried on one center, that in the head stock, and the outer end of the work supported in the steady rest.

The practice followed is to fasten the dog, which is attached to the work, by means of rope or similar medium to the face plate. For the fastening operation the face plate is screwed back a distance so that after the rope has been tied the action of screwing the face plate home tends to tighten the hold which the rope has on the dog and work.

At best this method is slow and unsatisfactory. Often when leather straps are used for the fastening means they stretch and the result is a drive which is not positive.

To overcome these difficulties the Ready Tool Co., Bridgeport, Conn., have developed a mechanical hold-back dog which can be set up easily and quickly. One of these set up in position is shown in Fig. 1.

It will be seen that the work is gripped by male and female vees, adjustment being provided with set screws A, one on each side. A bolt B passes through each driver and through one of the face plate slots. At the rear of the face plate springs are placed on the bolt B, which afford the flexibility of lacing but superior in that a spring has no permanent stretch or give.

The bolts are adjustable with the knurled collar shown so that they may be set to cause the work to run true. The outer end of the work is supported in a steady rest in the usual manner.

The jig used when drilling the male driver is shown in Fig. 2. The forging is located by two angular blocks A and forced back against the rear wall of the jig with the screw B operated by the handle shown. Two holes are then drilled, one in each boss, the drill being guided through bushings as shown.

A similar jig is used when drilling the female driver, shown in Fig. 3; the only

FIG. 1—HOLD BACK DOG SET UP ON LATHE

FIG. 2—DRILLING THE MAIN DRIVER

FIG. 3—DRILLING THE FEMALE DRIVER

FIG. 4—MILLING THE SLOT

difference is that a raised block which fits in the depression of the forging is used as the locating medium.

The forging is forced and held back with a screw of a similar design to the tool last noted, two holes are now drilled, afterwards being tapped to suit the set screws.

An interesting feature of the drill jigs shown in Fig. 2 and 3 is the method of holding the piece.

This is by means of a nut riveted to the end of a threaded rod. At the outer end of the rod is attached a crank, the turning of which holds or releases the part according to its rotation.

This medium of a crank for operating the holding device is both quick and positive and could be copied to advantage on the design of many jigs and fixtures.

In Fig. 4 is shown the method used to machine the slot in the drivers, male and female.

The piece is located by two pins A, which fit in the drilled holes. Nuts, as shown, hold the forging securely.

The milling machine table is then fed to stop against the revolving cutter B, which finishes the inside of the slot and also faces it. The table is afterwards fed up or down until the full length of the slot has been machined.

The rest of the elements used on the dog are simple lathe operations and need no detailed description.

The forgings are afterwards polished and hardened when they are ready for assembling into complete hold-back dogs to the form already shown.

GAS FIRED BOILERS

By M. M.

It may usually be taken for granted that where power is to be generated from gas fuel it is more advantageous to instal an internal combustion engine, but many cases arise in which, for considerations overriding that of thermal efficiency it is desirable to burn the gas under boilers serving a steam engine, and in such cases it is important that the boilers should be well adapted to the special requirements of gaseous fuel combustion. In discussing the suitability of various types of boiler to gas firing, there is a disadvantage in the Lancashire boiler when gas-fired in any of the usual ways. The fall of temperature in the gases from one end of the flues to the other is not sufficient to set up good circulation of the water as is done by the intense local heat of the fire when the boiler is coal-fired. Boilers of the Lancashire type intended for gas firing would be better with three or four flues, instead of the usual two, as that would not only give a larger heating surface, but aso allow of smaller volumes of gas being burned in each flue, which would enable combustion to proceed with a smaller excess of air. Carrying this line of argument a little further and keeping in mind the advantages of the flue boiler over the water-tube boiler when using feed water of doubtful quality, the best results would probably be obtained by having a boiler with a considerable number of smaller tubes, forcing the gas to burn at the highest possible temperature in each, with no obstruction in the tubes and no mechanical suction. Such a boiler, properly insulated, would give at least as good results as the best water tube boiler, provided that the correct ratio of boiler length to flue diameter was ascertained. This could be worked out at a comparatively small cost by experimenting on pipes of different diameter and length immersed in a water tank. Wherever high-pressure boilers are to be installed there is little doubt that water-tube boilers will be chosen if the available feed water is soft enough, or can be suitably treated. It is important that sufficient combustion space should be provided for the huge volumes of gas to be burned, so that the gas may be fully burned before passing through the tubes, but external combustion chambers should be avoided as causing unnecessary losses by radiation and conduction of heat and because the highest temperature is not attained in the immediate vicinity of the tubes. The two great drawbacks to the gas-firing of boilers as against their firing with coal are the low rate of evaporation per square foot of heating surface, which with the best water tube boilers is seldom more than 5 ½ lbs to 6 lb of steam per hour, and the relatively low efficiency obtainable. The best boiler up to the present is unquestionably a water-tube boiler which is arranged so that the gas can be fully burned before passing through the tubes and where the gas stream is kept at right angles to the line of the tubes by careful baffling, and to get higher outputs from such a boiler per square foot of heating surface only requires a more rapid combustion of the gas, with more intense flame temperature. Because of the low rate of evaporation and low efficiency of gas boilers, the project of gasifying steam coal, recovering the by-products and burning the gas under steam of boilers has not made much headway, as it has been found that steam can be raised more cheaply from the coal direct, even after allowing for all the income derived from the sale of by-products. Even now there are moddern producer plants and boilers on the market which can make gasification and gas-firing a commercial success under suitable conditions, and improvements are to be looked for.

DRESSING TARPAULINS

For temporary protection against rain, tarpaulins are largely used, this causing an annual dressing to be necessary. In arranging for this all necessary repairs should be done, and the sheets should be laid out open and thoroughly brushed and cleaned on one side, being afterwards hung up to dry thoroughly. When dry they should be thoroughly dressed on both sides with one of the various dressings sold for the purpose, or they could be done with one made up as follows:—14 lbs good black paint, 1 lb powdered litharge, 2 pints oak varnish, 1 pint boiled linseed oil and 1 pint thick boiled oil, well ground together and passed through a strainer to secure smoothness. After the first coat has dried, the outside of the sheet should have a second coat, the dressing and drying occupying about three weeks in fine weather.—D. S.

CINDERS

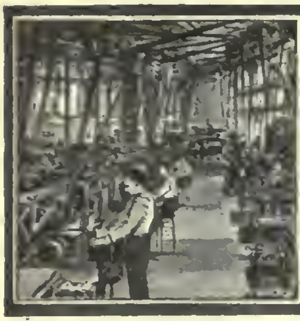
By T. H.

In view of the fuel shortage, present and prospective, particular importance attaches to cinders. According to an estimate made recently 3,745,000 tons of cinders are either tipped or burned in British municipal destructors every year, and this cinder fuel is equivalent to no less than 2,675,000 tons of coal. Some of the more enlightened local authorities utilize the cinders for steam raising purposes, but the comparative fewness of those bodies may be judged by the fact that this economic use absorbs only about one-eighth of the total quantity of cinders collected by the municipalities, thus leaving the equivalent of 2,226,000 tons of coal absolutely thrown away. London is alleged to be one of the worst offenders, but even in the Metropolis there are a few municipalities which, before the era of fuel rationing, had kept a wary eye on the calorific potentialities of the dustbin. The recovery of cinders, now allowed to go to waste, reckoning coal at 26s a ton means an annual saving of £2,894,000, and on the basis of the 1916 output a year's labor of 11,000 miners. Coal rationing will no doubt stimulate private economies, but it may not have occurred to the authorities that the scarcity and dearness of sieves and sifters militates against private effort in this direction.

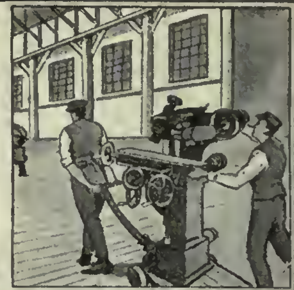
NEW APPRENTICESHIP SCHEME

By R. E.

It is to be hoped that more will be heard of the highly interesting scheme of apprenticeship which is being taken in hand by a big London grocery firm. The the old plan of apprenticeship as interpreted in these days has outworn its usefulness is obvious, but it is equally obvious that something must take its place if our commercial ascendancy is to be maintained. This wise and enterprising firm offers to boys who will engage for three years, working six hours, seven hours and eight hours a day respectively, facilities for education at a continuation school in the first year, at the Grocers' Institute in the second, and at one of the best London business colleges for the third year, the firm paying all expenses, and gives wages of six shillings, twelve shillings and eighteen shillings in the three years. The result of this should be that boys who care to apply will be thoroughly outfitted with a sound commercial education side by side with practical knowledge. If some such plan became general in big cities the whole standard of commercial acquirement would be raised to the benefit of both parties and of the State.



DEVELOPMENTS IN SHOP EQUIPMENT

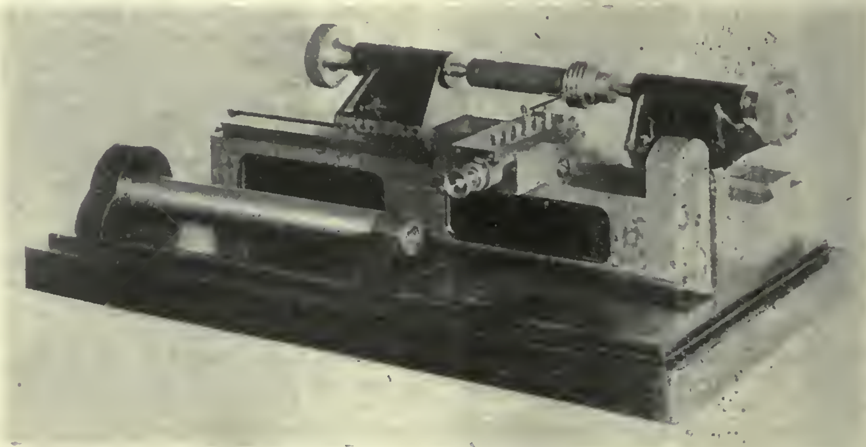


Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

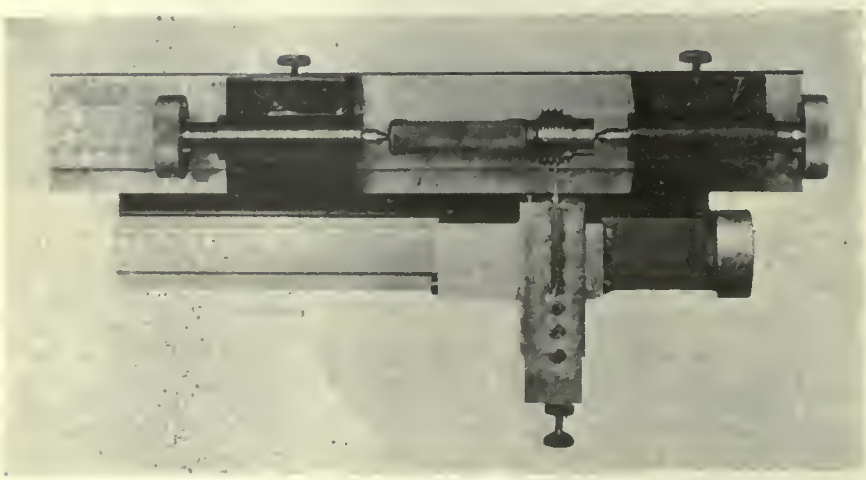
LEAD TESTING MACHINE

This machine was designed with the idea of providing a very rapid and accurate method of determining the error in lead of screw thread gauges and to enable those required to pass upon large quantities of gauges to secure dependable results in minimum time.

It will be noted that the device consists primarily of a cast iron bed machined all over with two parallel dove-tail bearings on the top. Upon the rear and larger bearings are mounted the centers for holding the gauge to be tested and upon the front bearing is fitted the sliding block which carries the indicator slide. Upon this slide is mounted the indicator which is held in place by means of a hardened stud which is clamped in position with a small headless set screw. Both the sliding block and the indicator slide, which has a dove-tail gibbed bearing in block are sufficiently long to afford ample bearing surface and by mounting the indicator in the proper bushing the operator is assured of a full bearing of slide in block when machine is in use.



SHEFFIELD PRECISION INDICATOR.



SHEFFIELD LEAD TESTING MACHINE

The indicator slide is provided with a knurled stop screw with lock nut giving assurance that the indicator ball will record from the same point on the angle of each thread after being set in first thread to be tested.

The Deming precision indicator, also a Sheffield product, which is used to record the amount of error, is an extremely accurate tool and is graduated to read in ten thousandths of an inch and the scale is so arranged that fractional parts of tenths can be very closely estimated. Several sizes of ball points are furnished to enable readings to be taken of any pitch—the finer pitches, of course, requiring the smaller points.

The gauge to be tested is mounted between the centers as shown, the heads bing clampd in desired positions by means of knurled binding screws in rear. A Johannson block is inserted between the contact points to obtain zero reading. One of these contact points is on the sliding block and two in steel plate projecting upward from end of bed. The indicator slide is then pushed toward the gauge until the ball point of the indicator slide comes in proper contact with the angle of first thread to be tested, the stop screw set and locked. The gauge is either turned slightly or adjusted longitudinally by releasing one and advancing the other center by means of the threaded center spindles with knurled heads until the indicator needle reads zero on graduated scale.

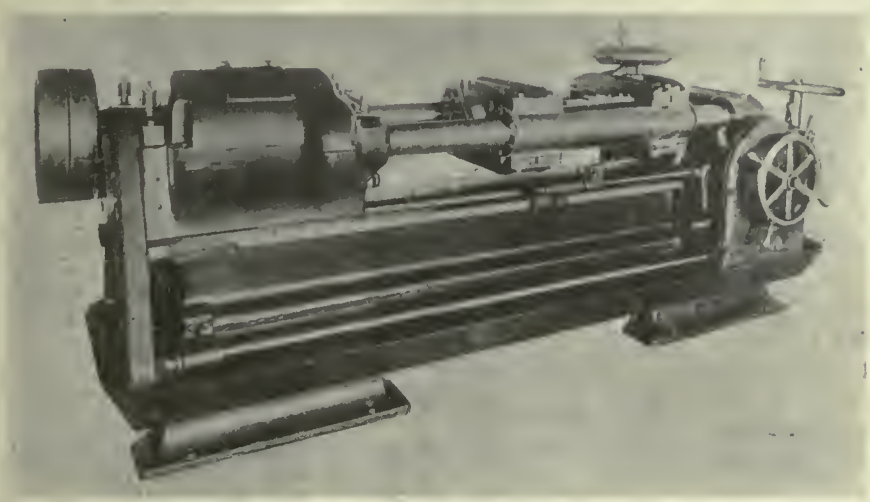
It may be assumed for convenience that the gauge to be measured is 8 pitch; it will be readily seen that it to the initial Johannson block is added another measuring. 125 in. and the slide brought against this combination as before that the indicator needle when point is again brought in contact with thread would still read zero, providing the distance between the two threads is exactly 1-8 in. Should there be an error of .0001 in. or even .00005 in. in lead either way it will be clearly shown on the scale. In the same way that the 1-8 in. block in combination with the one used for the first reading gives the correct lead for the first thread, using the 1-4 in. block would give the lead for two threads or the 1-2 in. block for four threads, etc. Other combinations can be readily made up in this manner for any lead, either English or metric, (the latter by using metric blocks) with no chance of error as the use of a micrometer or screw measuring device of any kind is eliminated. In fact the complete unit may be described as a holding fixture for the work and a measuring system, both as simple and dependable as it is possible to make them.

A machine for such accurate measurements must necessarily be very accurately built and we therefore are extremely careful as to the quality of material and workmanship which enter into its construction. The castings are well seasoned and all alignments are accurate to within a fraction of a tenth. The hardened and ground test bar shown, one of which is furnished with each machine, is provided to enable the user to check the alignment of the two parallel dove-tail bearings on bed to detect any wear which might affect the accuracy of the results obtained.

Either straight or taper gauges can be checked with equal facility and with the aid of a chart furnished accurate measurements may be taken of the form of thread. Gauges and taps 3 5-8 in. in diameter and 10 in. long can be accommodated between centers.

Each machine is furnished with an attractive wooden case and is complete with test bar as shown. Measuring blocks are not included as part of regular equipment.

This machine is manufactured by the Sheffield Machine and Tool Co., Dayton, Ohio.



CYLINDER BOR NG MACHINE

CYLINDER BORING MACHINE

This specialized machine was designed by the Reed-Prentice Co., of Worcester, Mass., for boring the cylinders of Liberty Motors. In the several months that they have been in operation they have accomplished more than was expected of them in the rapid removal of metal accurately. The head unit is very rigid and massive and contains a herring-bone reducton. The bearings are bronze with sight feed oilers. The spindle is hardened and ground on all bearing surfaces. All gearing is entirely guarded with hand hole covers tains a herring-bone gear reduction. The drive is in single pulley 18 in. x 6½ in and gives but one spindle speed. For other classes of work the gearing would have to be redesigned for the work to be performed. The feed is positive gear drive through a single train and is designed for the class of work at hand. In the apron the feed is by worm with approximately a 100 to 1 reduction. There is a positive and automatic knockout to the power feed. There is also an auxiliary worm which can be thrown in when it is desired to use the hand wheel feed for rapid movement of the carriage.

The carriage in the photograph is of special design to hold a Liberty motor cylinder. This is arranged with a quick acting clamp which centralizes the cylinder and holds it securely for the boring operation. When the proper depth has been reached the carriage feed is automatically tripped and the feed stopped. The carriage is supported on two extremely large heavy ground bars instead of on the bed as is the usual practice. This is to give direct support in line of pressure when the machine is in operation and prevent any distortion of the bed. The end pressure while boring is tremendous, and this is all taken up by tension in the bars with little or no strain on the bed. The bed has been made extra deep and wide, well braced with ties to give the machine a rigid foundation. An oil pan is provided for the cutting compound. This machine as can be understood from the above description, can, by slight changes in design of gearing, etc., be made to accommodate most boring operations.

CONVOY ORDERS

The convoy system is now an integral part of our naval policy, but it is only after much effort and considerable experience that it has been possible to bring it to its present efficient state. Credit is due not only to the Navy, which escorts our shipping, but also to the masters of the merchant ships which form the convoys, as without implicit obedience on their part and a thorough understanding of what is expected of them, the value of the escort's protection would be much reduced.

An important part of a convoy's organisation is the conference, which has been found invaluable and always necessary in the case of large ocean-going convoys. This conference is really a lecture which the master of each ship about to sail in the convoy has to attend in order to receive his instructions for outwitting "Fritz" during the forthcoming voyage.

Picture to yourself a smallish room with dirty whitewashed walls and a long deal table running down the centre. At one end is a raised platform facing a large blackboard covered with little discs; at the other is a small table littered with multifarious documents, guarded by a Naval Reserve officer.

Grouped round the table, some sitting, others standing, are about 40 masters of all ages; jovial-looking, fair-haired Swedes are mingled with tall and serious-looking Norwegians and Danes, while the remainder are obviously British. Some are attired in well-cut blue suits and "bowler" hats, others are content with a suit of "reach-me-downs" and a muffler, but the stamp of the sea is clearly marked on each face.

A corner of the room contains the commanding officers of the escort vessels, and in front of the platform stand the port convoy officer and the senior officer of the convoy itself.

The port convoy officer, who is a captain R.N., mounts the platform and gives his audience the general instructions for the voyage. Each ship is assigned her place in the convoy, which is shown in miniature on the blackboard. Emergency signals are explained and the importance of darkening lights at night and keeping a good look-out by day are particularly emphasised. Most of the masters are "old hands" used to convoys and the orders are not new to them, but nevertheless not a word or a shuffle interrupts the lecturer.

All the neutral masters speak and understand English perfectly and have unbounded confidence in the Navy, which enables them to follow their livelihood with a daily increasing degree of safety. For four years now these men have sailed in submarine and mine-infested waters with but little personal gain, knowing that their lives are in the balance on each voyage; but they never shrink from their work and carry on for the good of their own country and ours.

Notes are taken as the lecture proceeds, and finally the masters are asked if everything is quite clear and whether they have any questions to ask. One master is not quite certain of his procedure in the event of sighting a torpedo heading for his ship; this is at once explained to him. Another apologises for dropping astern during a previous voyage, explains how he was let down by inferior coal and hopes he will be able to maintain the convoy sped in future.

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Get Ready For Peace Now

THERE may be quite a fight left in the Hun yet. It is well to reckon that the Hun war machine will reform this side of the Rhine and fight. With the whole caboose of them taking to their heels it's an easy matter to sprout a heap of cocksuredness that will do all sorts of damage.

That means that the war effort is to be sustained. At the same time there is no reason why manufacturers cannot plan ahead. One guess is as good as another regarding events that will take place after the war. But the one best guess is that business and trade will go to those who are in shape to go out and get it.

There are evidences already showing that plans are being made by some of the best executives on the continent to meet the period of uncertainty that will follow immediately the cessation of war. The head of one big concern announces to his selling force, which covers this continent, that his policy right now to protect his company is that no cancellations of contracts shall be allowed. It is not always possible to carry this out but there is good reason to urge it where at all possible. Cancellations, when they become chronic, kick the bottom out of business as fast as any other agency that is known. Manufacturers and dealers should protect themselves as far as possible in this way. Readjustments are hard to make in many cases, and in the majority of deals they are not satisfactory.

The selling forces in many cases have become "soft" since the autbreak of the war. Business has been pelted at them. They have not had to dig for their prospects. At best their work has been mainly seeing how close they could keep to delivery promises. It's good business right now to get the selling forces trimmed for the day they will have to get out and sell once more. It's good business to get the advertising campaigns in shape for the season of competitive business that is nearing.

None of these things mean that there should be any slackening on war efforts or production. They are all part and parcel of a sound and sane policy of good business.

Don't allow the cessation of war orders to find you at the stage where your only move is to fire the staff and spar for time.

Not Down to Brass Tacks Yet

THE people of this country may think that they know what it is to have the line drawn between essential and non-essential industries. As a matter of fact they know little or nothing about it.

There's a heap of wasted energy running wild in this country. If you take the trouble to do so, you can look around your own community and see it.

On a business street of Toronto there have been erected in the last few months four stores. It took labor and money and material to put them there.

One of the stores sells cigars, newspapers and magazines. Another deals in optical goods; the third is a music store and the four is a shoe shine stand.

The residents would have done very well, indeed, without any of these establishments coming into existence. The community was well served with cigar stores before. It was never known that a family had moved out because there was a lack of cigar stores. There are a number of optical parlors in the same district, and hundreds of places in the city where you could squint at the elusive letters and go out with a set of fixtures on the end of your nose. Of music stores and shoe shine parlors nothing need be said more than to add that to see a string of able-bodied men sitting on a bench while some other able-bodied foreigner dabs and whisks at their shoes is apt to give a sensible man a pain in the ribs. If the family altar needs to be revived, so does the family shoe shine box.

All that labor and all the labor needed for the upkeep of those places is, in the last analysis, non-essential. That case can be duplicated hundreds of times all over the country.

Canadians don't know yet what it means to get down to brass tacks.

We're Busy Dodgin' Germs

OH folks imagine nowadays that every place they turn, some person's waitin' for to hoist on them a Spanish germ. They see them settin' on the road, and campin' on the trees, and scatterin' forty different ways whene'er they hear a sneeze.

They're sprayin' dope on dollar bills that camp inside the bank, they're killin' germs that venture there, the fat ones and the lank.

You see a man come in the car, there's murder in his eye, to see if any germ-stuffed jay is comin' on too nigh—he sizes up the line what's there, and if he hears a sneeze, he trembles from his stomach up and wabbles at the knees.

And when he goes to get some grub he grabs the battin' card, and gazes at the things thereon and ponders long and hard.

He's sure the soup is full of germs, on fish they'll camp, 'tis true, and on the liver and the rice will dwell ten million Flu—the waiter, too, his eye looks bad, there's death upon his paw, there's torture written on his chest and sickness on his jaw.

That waiter should be run right in and planted in the coup, this thumb with sixteen kinds of germs has gamboled in the soup.

Oh, there ain't much fun in livin' now. I'd rather be a worm, what camps inside some lonely spot what's free from any germ, than hoofin' round the streets these days a-scared of folks like you, what's tryin' to fasten on to me big hunks of Spanish Flu.—ARK.

IF you are thinking of going out on strike, just remember that there are thousands of the best men this country has ever produced who have been taking their lives in hand for years now at $1.10 per day.

JUDGE A MAN BY STARTING POINT

Hugh Clark Worked and Asked Questions and Studied All At the Same Time.

EMPLOYEES of the Singer Sewing Machine Works at Clydebank, Scotland, at least those of the old guard whose memories go back 30 to 35 years, could tell you of a lad they all called Hughie. They could tell you how this little more than toddling lad worked in the packing rooms of that 30-acre plant. With reminiscent smiles they could tell you how, along in the year 1888, he soberly announced intention to go with his parents to Canada. And as he fitted the action to the word a few weeks later it is our privilege to report his measure of success in this land of recompense for intelligently directed effort.

HUGH CLARK

Hugh Clark, or "Hughie" still to his intimates, started work in Canada as a carder in the Standard Woollen Mills. With the lapse of 10 years in this Toronto plant he stood at the gateway to the age at which a young man either strikes out for the thing he wants to do most or passively accepts his lot and rears a grouch upon it. He could be a carder to the end of time or he could buckle down to grimy toil and lamentably neglected studies and so fit himself for the work he mightily wanted to do.

To his credit, young Clark arranged for a transfer to the fireroom in the Standard Mills. Here for four years he worked as a fireman in a double sense. That is to say, he stoked, and he fired questions at all and sundry who could let him into the mysteries of boilers, engines and anything and everything mechanical.

And at length, when he was ready, opportunity was ready too. The power plant of the W. A. Murray store, Toronto, needed an assistant engineer. Clark got the job.

Three years later this privately owned plant was closed. And where do you suppose was opportunity? Just a few blocks to the south-east or, to be precise, where Berkeley street is lost in a maze of railroad tracks, the Joseph Simpson Sons, Ltd., Knitting Mills had to have a night engineer. Clark proved that he was competent.

That is 13 years ago, and for these last 11 years he has been, and is to-day, mechanical superintendent of the Simpson Mills. So if you are ever tempted to doubt the value of a good correspondence course in steam and electrical engineering or to underrate the practical help a man can get from such a paper as CANADIAN MACHINERY, go and talk with Hughie Clark.

In the big game named "getting ahead in the world" he has made a creditable score. I say that well knowing it is never wise to measure a man by the position he holds to-day. Rather stand in his shoes, if you can, and drop your plumb line to the job at which he started.

THE Kaiser's big job now is not the winning of the war, but saving enough out of the scrap heap to provide underwear and fodder for himself and family.

* * *

THE Toronto "World" announced that the Page-Hersey Co., of Guelph, had secured a large order for 155 H.H. shells. These H.H. shells are something quite new to us. No doubt the H.H. stands for "Hun Hitting."

"You're fired!"
—Ireland, in Columbus Dispatch

CHEAP LABOR WAS NOT VERY CHEAP

(Continued from page 481)

civilized locality makes the general executive very chary of making a change. All these factors made life hard to bear in ordinary times, but with the advent of war, bringing with it the highly paid munitions work, the position of these factories went from bad to worse. Being within 30 miles of a large centre, with its enormous demand for labor and the high prices offering for the skilled and unskilled variety, practically all the help of any value decamped en bloc. Those that were left naturally demanded higher wages. These were granted but had no effect on production as the higher wages simply enabled these workers to earn the same or better money for less hours work, a situation they promptly availed themselves of. The position of the works manager who is expected to keep up production can readily be imagined. These cases are not exceptions but are quoted as concrete examples.

There is no question but that in both these cases money would have been saved if these factories had been located in a large centre without any initial saving due to cheap land and exemption from taxation and without the doubtful advantage of cheap (?) labor.

It would always be advisable when settling on the location of a factory to look into the general conditions, such as housing facilities, educational establishments, and general characteristics of the surrounding population. It would be a good rule for the party making the choice to consider if they themselves would like to be sentenced to live there and bring their families up. Man does not live by bread alone, and the neglect of considering this may often militate against the success of an industry where other things are most favorable.

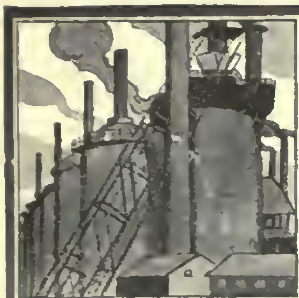
THE community is divided into two great classes now, viz., them what's had the Flu and them what ain't.

* * *

IT shouldn't be much of a job to grab the Turkish army if the soldiers wear the sort of trousers the Turks are generally pictured as wearing.

* * *

CIVIC officials used so many civic autos in Toronto going to the ceremony of opening a new road that private cars had to be secured to carry nurses to attend to influenza patients. All the ceremony needed to open the road was a couple of huskies to knock down the barricades.



MARKET DEVELOPMENTS

War Orders Growing Under German Peace Talk

The Only Uncertainty Now is in the Case of Machine Tool Dealers Where Deliveries Are Not Possible Until Well on in 1919—Some Firms Are Refusing Business That Carries a Cancellation Clause

THE war orders being placed by United States Government since the beginning of the German peace talk are greater in volume than they have been for some months past. That is the feeling in the steel industry and it is reflected in the trades most concerned in the production of munitions. As a matter of fact it will not be long before the production of shell steel is at the rate of 600,000 tons per month, a figure that has not been yet attained, but developments show that it is not impossible.

The only element of uncertainty entering into the situation now is for the machine tool trade. Their position is different from that of the contractor for munitions. Business placed now for war plants is placed on the known fact that delivery cannot be made for some months yet, and it will be still longer than that before the machines can come to the point where they will be taking their place in the production returns in the way of delivered shells. Figuring on business a month in advance is not the problem of the machine tool trade. Rather they are right now trying to figure out what conditions are apt to be toward the end of the first half of 1919. The rapidity with which events are developing on the Western front is not making their task any the less difficult. If the terms of the Allies are unconditional surrender it means that there will need to be a lot of metal shipped across the ocean before the last chapter is enacted.

The influenza epidemic is interfering to a rather serious extent with the production of munitions in some of the shops. For instance in one shop in Toronto where there are 2,800 hands on the payroll almost 600 are away now, and the disorganization is felt in the output figures.

Some of the large machine firms have sent out very explicit instructions to their selling agencies that they will not take on any business that has a cancellation clause attached to it. They are taking this step to protect themselves during the period of uncertainty that may follow the declaration of peace. Any business that they take on now must be on the distinct understanding that delivery will be made and the machine paid for regardless of the trend of the war. Of course there are other firms that have not made any such rules, and they are willing to consider cancellations, subject, of course, to satisfactory adjustments covering the labor costs already incurred.

SICKNESS CAUSES FALLING OFF OF PRODUCTION IN MONTREAL

Special to CANADIAN MACHINERY

MONTREAL, Oct. 24.—Industrial and commercial activities throughout this district have been seriously interfered with by the raging of the influenza epidemic that has been scouring the country. Many of the plants in Montreal are operating away below the maximum owing to the sickness of large numbers of their help. Production has been falling off for the past two weeks, and likewise deliveries, owing to the difficulties under which the railroads are operating. The demands for steel are as insistent as ever and the same regulations as those effective for the past month still apply. Essential requirements are still excessive with jobbers unable to obtain material for many of their customers. In general the situation has been little affected by current peace talk, but it can hardly eliminate the undertone of nervousness that appears to prevade the market. This has been reflected somewhat in the reduction of orders that are being placed for distant requirements. Plants working on American ammunition contracts are actively engaged in acquiring their full complement of machinery, and for this reason are unable to operate at the maximum. In this respect it has been intimated that little impression has been made by the possible approach of peace, as in all likelihood the contracts now under way will be completed.

Steel Production Affected

Efforts are being made to maintain operations in spite of the activity of the influenza that is biting into the numerous offices and factories throughout the district. The situation in regard to steel plates shows little relief and the difficulty in obtaining material except for the most necessary purposes is as acute as ever. Local mills are compelled to work under additional pressure owing to the number of men that are away, so that in consequence the general output is considerably below the average for the period. Dealers report that in some respects the delivery of material from the States has been delayed and the cause of this is generally conceded to be the prevailing shortage of help for the operation of the rolling stock. A factor that is beginning to influence the trend of activities is the possible effect that an early peace may have on the industrial situation. While to all appearances the business continues as brisk as ever there is some tendency to retrench, particularly in the direction of covering requirements for future operations. This has as yet not been felt regarding existing activities but the undertone is quite pronounced in many places. Operations on the American shell contracts are showing no reduction apart from the local influence of the raging disease, a feature that has depleted the local plants to no small degree. Asked as to what the effect of peace would be on those firms now working on these orders, CANADIAN MACHINERY was advised by a representative of Lyalls that it would make very little difference at least in the immediate future, as firms working on American orders would still continue to do so, as the initial contracts would be completed. However, in the event of peace he intimated that it was very unlikely that they could expect repeat orders, especially in connection with munition work, but this would not apply to many other accessories such as clothing and general equipment, as the men at the front would require replacements for such time as they were away from home or until they were discharged from the service. General conditions in all branches of activity show little change, and apart from the uncertainty that prevails, the situation is going on as usual, with prices holding firm.

NO CANCELLATION CLAUSES INSERTED

Machine Tool Dealers Are Playing Safe In Regard To The War Shops

TORONTO.—There is an element of uncertainty entering into some of the business transactions that are taking place or hanging fire just now. That is to be expected. It all comes back to the old question, "When will the war end." The man who can sit down and figure that out for you can do a great deal just now to tell the machine tool trade what the best move is.

The scrap metal situation is best described as being stagnant this week. Some of the large dealers state openly that they are not in the market for material at all.

Prices for the most part have remained at the levels of the last few weeks, although deliveries are reported more satisfactory.

Material Still Scarce

There have been some shipments of sheets reaching Toronto this week, but they are not in keeping with the business booked against them. Galvanized sheets that are being delivered now are selling for $11 up, mostly up. As a matter of fact, the $11 figure does not exist now as a selling mark, and prices are running at $12 and $12 50. Peace talk has had no effect on the calls that are made on the material. There is a fair amount of the lighter sizes in plate still on hand in Toronto, but for the heavier sorts the scarcity is felt. Ottawa does not sanction extension to plants, even for the production of munitions, but will grant permits for material that is required for the upkeep or repair of existing plants, with a view to keeping production up in size and quality.

Dealers are finding it hard also to keep up an assorted stock of tubes. Especially is this so in the smaller sizes. In pre-war days a dealer kept a standing order at the mills for perhaps 100 tons assorted per month. The mill knew just about how to mix them for lengths and sizes, and went pretty much on their own initiative in keeping the stock up. But since the war programme has such preference in almost everything now, all these arrangements have ceased to exist, and as a result it is not an uncommon thing for warehouses to find that they are out of certain lines almost continually.

The Scrap Situation

"We are practically out of the market at the present time," was the way in which one of the big yards in Toronto sized up the situation this morning. He was inclined to think that peace talk was to blame for his trouble, as there had been a very acute falling off in the week after the first real peace talk had come to the surface. As a matter of fact, there has not been the call for scrap for some time that has existed across the line. The prices that are quoted now are nominal in many cases, the dealers state. They are not keen to buy at the figures given because they have no place in sight now to dispose of the material, and they are not inclined to stock up their yards under these conditions.

The Machine Tool Trade

It would be useless to disguise the fact that there is an element of uncertainty entering into the machine tool business at the present moment. The trade knows quite well that the time must come when they shall get off war trade and make the necessary adjustments for a peace time footing. The approach of that season has not been lost sight of. One item that comes largely into the business is the indefinite air that is attached to deliveries. When orders are placed now it really amounts to contracting for business that will not take place until well into 1919, because machines ordered now could not be finished and delivered, and give production before well on in next year. If the thing were permissible, one might sum up the situation by saying that the machine tool trade want to play safe and yet handle all the business they can accomodate.

No Cancellations

Letters have been sent out by the heads of some of the largest machine tool firms on the continent giving absolute instructions to their selling forces that they will not accept any business now that has a cancellation clause attached. As a matter of fact there are cases where a substantial cash payment is asked for when the business is placed in order to protect the tool manufacturer against any eventuality that may turn up. Speaking of this matter the manager of one of the largest businesses in Toronto stated to-day, "We are going through our files now, and any business that has been there for three or four months is going to be well sorted. We want to know for a certainty if it is still good, and if not we want to get rid of it. It is not the time to be carrying any more unfilled orders than is necessary. Experience does not show that the making of adjustments has been satisfactory in the past. It is almost better to risk some future business and adhere to the non-cancellation idea. We have been trying to find out from Ottawa what is in the mind of the Munitions Board there, but so far this has brought us very little assistance.

Another manufacturer, who spent some time in Washington a week ago, stated that at that time there was no talk of any let-up in the manufacture of munitions, or in the matter of prosecuting the war. "These two things go together," he stated, "and the feeling in the American capital seemed to be that when you heard that peace had been signed you would hear that war

POINTS IN WEEK'S MARKETING NOTES

The production of steel has not been interfered with at all by reason of the peace talk.

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U. S. Government orders for steel have been heavier since the German peace drive than they have been for some weeks past.

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The output of shell steel in United States is now at the rate of about 600,000 tons per month.

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Some of the users of scrap material claim that dealers have been getting high prices for material that does not come up in quality to heavy melting of good order, and that as soon as peace is declared there will be a tendency to "hit back" at these traders.

—

Some of the machine tool firms have sent instructions to their selling agents that there shall be no cancellation clauses attached to the business accepted by them from now on.

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In one Toronto shell shop where 2,800 hands are employed, over 500 are off at present with the influenza, and production is being interfered with to some extent. One factory doctor states that he fears the spreading of the disease more by the men after they have returned to work.

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One of the largest scrap metal dealers in Toronto stated that his firm was practically out of the market for the present. They are not buying except under very exceptional circumstances. They are well stocked and future sales are not much in evidence.

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New York reports that the Teutonic peace talk has stimulated interest in the production of war material in that district.

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Large orders are apparently to be placed for gas shells, to be made by the semi-steel process. Canadian foundries may take over some of this work.

contracts had been cancelled. Of course the feeling may have changed during the past week," he concluded, "but from what I could gather during my stay there it did not seem likely that the war work would stop for some time yet."

That feeling seems to be shared by a good many who are closely in touch with the situation. They do not believe that so great a thing as the German war machine is going to cave in all at once, and that peace will come in an instant. The feeling is that the German war machine has got to be smashed to a pulp, and that it is going to take a lot of material to do this

tile plant will be widely distributed; because of the urgent need of quick deliveries, practically all of the crane makers will share in the work. The Department has given a contract to the Barney Ahlers Construction Corporation of New York for the building of a gas defense plant on Governors' Island. The Durstan Gear Corporation, Syracuse, N.Y., is to manufacture transmissions for motor trucks to be used in France.

The Cast Shell Order

Two contracts for a total of 600,000 4.7-inch shells have been virtually closed with two manufacturing interests, but the confirmation of this order must wait the passing of the deficiency appropriation by Congress. It will be recalled that the Government is about to place contracts for 30,000,000 semi-steel gas and smoke shell, in this section, including 24,000,000 6-inch and 8-inch shells, all of which will be completely machined. The 6,000,000 4.7-inch shells will be only partially finished. It is estimated that to produce 250,000 six inch shells a day, 22 machining tools and ten tool room machines, including turret lathes and screw machines, will be required. Some of the plants that will help to provide these shells are already fully equipped and the Government will provide a machine plant for the foundries which have the necessary floor space to accept large casting contracts. If the machinery cannot be obtained from the regular machinery makers, arrangements will be made for manufacturers who have not previously made machine tools to enter the Government service. Foundry interests in the Birmingham, Ala., district, are being urged to accept contracts for 3-inch shells calling for an output of 80,000 per day.

Canadian Interests

Buying of machinery for the manufacture of pistols is still held in abeyance, but the Government is expected to act speedily to meet the needs of ten different concerns that have been given orders for Colt pistols and among these are: Carem Bros., Montreal, and the North American Arms Co. of Quebec. Orders in the United States have been placed with the Winchester Arms Repeating Co., New Haven, the Savage Arms Corp., which is operating a factory at San Diego, California, as well as one at Utica, N.Y.; the S.-S.-E. Co., and the Lanston Monotype Machine Co.. of Philadelphia; the National Cash Register Co., Dayton, Ohio, and the Burroughs Adding Machine Co., Detroit. Thos. A Edison, Inc., Orange, New Jersey, will manufacture adaptors for 75-mm shells and is about to come into the market for shop equipment.

It is an interesting fact that the Emergency Fleet Corp. will discontinue the building of ships which cannot be completed in 1919, and as a number of the yards are already behind in their contracts, the demand for marine plates and shapes will be less pressing than previously anticipated."

AMERICAN DEALERS HAVE TROUBLE GETTING SHIPMENTS TO CANADA

MANUFACTURERS have two kinds of problems in these days of stress. On one hand, there are those that stand out as unavoidable—such as scarcity of labor, difficulty in obtaining material, or in making deliveries—and finally, the "Flu" which seems to have mixed in and aggravated most of the other problems. On the other hand there are troubles that seem to be avoidable—which are all the more provoking because, very often, they seem to be beyond the capability of human explanation. Very often these problems are traceable to poor organization, or to a weak link in the chain of responsibility on which organization is developed. The crush of war work, for example, has brought to the surface the fact that in handling certain details official machinery is not beyond criticism—or to draw it more mildly, cannot always be understood.

Manufacturers who have been trying to maintain some kind of service on this export business are having their troubles—troubles that seem all the more troublesome because there seems to be no remedy—official or otherwise.

"Why, we have had goods made up for delivery for six weeks," said an American manufacturer, "and although they are wanted by a Canadian firm working on American war contracts we have the greatest difficulty in getting the necessary official permits. This should be a case in which the necessary machinery should work smoothly and with despatch. Speed is essential,and when there can be no doubt that the industry is working on munitions, there must be plain sailing."

"Should you desire the information," remarked another manufacturer, "I could probably tell you when there is a mighty fine ivory mine. We have had some steel on order here for weeks, but cannot get the necessary permit to shoot it across. Why? We have filled out all the information that seems necessary—except that there may be some doubt as to where my wife's great grandmother was born—but still the permit doesn't come. That steel is wanted in Canada by a firm working on an American contract. To my mind it makes no difference whether it is an American, British or Canadian war contract—we are all fighting the same thing—yet the permit machinery on essential material does not work smoothly. It's holding back important work."

As bearing out the statements by American manufacturers, a Canadian manufacturer engaged on an American contract, flourished a letter from U.S. headquarters, asking for some information that would help them form an opinion as to when they might expect their contract proceeded with.

"I am just writing them," said the manufacturer, "that just as soon as they release the necessary materials we shall proceed with the work. We have been held up for weeks. We have had the same trouble right here at home. There are officials who don't seem to realize that time is the essence of the whole matter."

The problem certainly seems to be a real one that there should be some remedy for—at least before the next war.

PEACE DRIVE CAUSES MORE WAR ORDERS

New York Says That Was the Effect Of Developments of the Past Week.

Special to CANADIAN MACHINERY

NEW YORK, Oct. 24—The Teutonic peace drive has stimulated rather than decreased war activities in this country. The Government is taking vigorous measures to push the output of both guns and projectiles. More contracts have been placed for war munitions in the last week and other important contracts are pending. As a result of these orders more machinery is needed for equipping new plants and in rounding out equipment of other works. It is notable, however, that October orders booked by New York machinery dealers have fallen below the average of September. The renewal of shell contracts increases the purchase of finishing tools.

The Ordance Department has given an order to the Marlin Rockwell Corporation for 75,000 light Browning rifles and for 15,000 aviation guns and an order has been given to the Pfau Manufacturing Co., Cincinnati, for over 100,000 water boxes. The Department has also placed further orders for machinery for equipping the Neville Island gun and projectile plant and the American Bridge Co., which is furnishing the structural steel for this plant, has now received definite orders for 57,000 tons, shapes which will be sufficient to meet matured plans well into 1919, but double this steel tonnage will be eventually needed. The two hundred or more small cranes for equipping this projectile plant will be widely distributed; because of the urgent need of quick deliveries, practically all of the crane makers will share in the work.

PEACE TALK HAS NOT INTERFERED WITH ORDERS OF U.S. GOVERNMENT

Special to CANADIAN MACHINERY

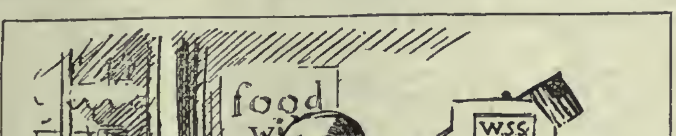
PITTSBURGH, Pa., Oct. 24.—Peace talk has attracted relatively little attention in the steel industry in the past fortnight. The steel producers are as anxious for peace as any, and face great complications and uncertainties in the markets and trade conditions generally in the period of re-adjustment, but they have no time to consider these matters being so busy endeavoring to swell production and distribute their output in strict accord with the regulations.

War Orders Heavy

In the matter of placing war orders for steel the Government has certainly shown no signs of relaxation for, if anything, orders have been heavier since the German peace drive started than the average of preceding months. Three large batches of orders for sheets have been distributed, making the buying the heaviest for months. Recent orders include 32,000 tons of 80-pound rails, for General Pershing, together with 150 locomotives. The 40,350 cars for General Pershing, on which bids were recently taken, are likely to be allotted shortly and the filling of the orders may further delay completion of the 100,000 freight cars which have been on order for domestic roads for several months.

Shell Steel

Fresh pressure is being exerted to secure still more shell steel. One important wire producer in the Pittsburgh district, which was kept off shell steel business for a long time on account of the need for its wire products, began making shell rounds a trifle over a month ago on one of its continuous billet mills formerly serving its rod mills, and this interest has now been asked to increase its shell steel production by 40 per cent. A little information has leaked out as to the actual tonnages of shell steel produced. It appears that in the early months of the year the total production was running at the rate of about 350,000 tons a month. The rate increased until recently it passed 500,000 tons a month, and a rate of 600,000 tons is expected to be attained this month or next. The indication is that the total shell steel output in the calendar year will be about midway between 5,000,000 and 6,000,000 tons. At 600,000 tons a month the output would represent approximately 18 per cent. of the total finished rolled steel output. The proportion of the ingot output involved in making shell steel is considerably larger than 18 per cent., by reason of the heavy discard required, but in practically every instance all the discard steel that can possibly be utilized is rolled into one finished form or another, chiefly for war purposes. The War Industries Board for several months past has been keen to find war uses for shell discard steel and has been quite successful. As a rule, when fresh orders are given a mill to roll shell steel, orders are given at the same time for the utilization of the discards, and only the material that cannot be rolled goes back to the open-hearth furnace as scrap.



The Kitchen Rangers cited for gallantry.
—Cesare, in New York Evening Post

Scrap Supplies Slightly Better

Reports from consumers in the past week are of slightly better supplies of scrap. The mills still claim they are very short of scrap, but on the whole the situation is a trifle easier. One theory to account for the improvement is that many railroads, finding labor so scarce, have adopted a practice of selling their scrap as gathered, without attempting to sort it, and this gets the material into the market sooner, though, of course, the supply in the long run would not be increased by the new practice. The Pennsylvania Railroad continues to sort and grade its scrap, and has been canvassing consumers with a view to their making contracts to take offerings in one grade or another, the contracts to run for three to six months. Hitherto the system has always offered its accumulation monthly, as a fresh offering. Another observation made as to increased supplies of scrap is that with the heavier deliveries of cars and locomotives to the railroads the roads are scrapping more old equipment. The scrap dealers have been thinking rather keenly on the subject of peace and recognize that when peace comes consumers of scrap will be prompt to "get back" at dealers for the trying experiences they have had, particularly in the matter of dealers holding extremely indifferent grades of scrap at the full heavy melting steel price of $29 delivered, material which mills say would frequently not bring $10 a ton in ordinary times Just now, with all mills striving for the last possible ton of output, they are forced to buy the scrap that is offered, but when opportunity comes to let down on the pressure their policy in the matter of buying scrap will be quite different.

Priorities for Controlled Consumers

For several weeks past the conservation division of the War Industries Board has been making agreements with various manufacturing consumers of iron and steel, whereby these consumers would limit their operations to certain rates, based on former practice. In many instances the arrangement has been for the consumer to operate during the last four months of this year on an average, at not to exceed one-half the average rate in a four-month period in 1917, i.e., production in the four months to be "50% of four-twelfths of the production in 1917." In the majority of cases these manufacturing consumers had no definite prospect of getting any steel, under the present regulations, to operate at all, and questions have been asked whether they were to be given any assistance.

The War Industries Board has now undertaken to grant certain priorities to manufacturing consumers who have entered into these arrangements. The degree of priority that will be given is not announced, but whatever it is it will be helpful to consumers who otherwise would have no claim for steel except through their being on the preference list. With nearly all the mills the priority orders are absorbing the output, leaving nothing for the preference list. The agricultural implement trade is an exception to this practice, as it already has B-2 priority, given as "automatic priority" in circular No 4 of July 1 last. This industry is limited to a 75 per cent. operation in the twelvemonth beginning October 1, 1918.

When Peace Comes

There are very few in the steel trade who think that the diplomatic interchanges of the past fortnight indicate a balance of probability that peace will come in the near future. The strongly preponderating feeling is that there is several months of hard fighting ahead, the actual time on the calendar depending largely upon weather conditions, which will determine how much of the fighting can be done this winter.

One thing, however, these diplomatic interchanges are regarded as suggesting rather clearly is that when peace does come, eventually, it will come suddenly. There will not be a long period of uncertainty. Acordingly, the change from war time to peace conditions in the market, and in the trade generally, will be a sudden change, not a gradual one. There have been strong intimations lately from Washington that the Government purposes to retain control of industry for a while after peace becomes assured, but the nature of the contemplated control is not known. While it has been pointed out that shell steel oreds would probably be cancelled instantly, while orders for shipbuilding and for the domestic roads would, of course, stand, there is thought in some quarters that the Government would early make a stand for lower prices, on the ground that with peace conditions and less pressure for tonnage output, steel could be made somewhat more economically.

CROWN PRINCE WILLIE HAS WRITTEN LETTER TO HIS "PAPA"

An American agent in Toronto for a big machinery corporation in the U. S. had the following sent from some of his American friends. It gives the U. S. view in an entertaining way:

On the Run, Somewhere in France.

Dear Papa,—I am writing on the run, as the brave and glorious soldiers under my command have not seen the Rhine for so long that they have started back that way, and, of course, I am going mid them. Oh, papa, dere has been some offel dings happened here in France. First, I started in my big offensive which was to crush de fool Americans, but dey know so little about military tactics dat dey will not be crushed be like I want dem. I sent my men in der fight in big waves and when dey got to the Americans dey all said "Boo" as loud as they could holler. Well, according to vat you haf always told me, de Americans should haf turned and run like blazes. But vat you tink? Dem fool Americans don't know anything about war, and instead of running de odder vay, dey came right toward us. Some of them was singing something about "Ve von't come back till it's over over there" or some other foolish song, and some of dem laffin like fools. Dey are so ignorant. But dey are offel reckless mit der guns and ven dey come toward us it was den dot my men took a notion dey vanted to go back to der dear old Rhine. Ve don't like de little old dirty Marne river anyhow. And, oh, papa, dem Americans use such offel language. Dey know nothing of kultur and say such offel dings right before us. And dey talk blasphemy, too. Vat you tink dey said right in front of my face? One big husky from a place dey call Kansas, he said—oh, papa, I hate to tell you vat an offel ding he said—but I can't help it. He said "To hell mit der Kaiser!" Did you ever hear anyding so offel? I didn't tink anybody would say such a offel ding. It made me so mad, I wouldn't stand and hear such offel ting so I turned and run mid der other boys. Vas I right? Vat? And, oh, papa, you know them breast plates vat you sent us—can you send some to put on our backs? You know we are going der odder way now and breast plates are no good, for der cowardly Americans are shooting us right in der back. Some of our boys took off der breast plates and put 'em behind, but der fool Americans are playing "Der Star Spangled Banner" mit machine guns on dem plates. Can't you help us? You remember in your speech you said nottings could stand before der brave German soldiers. Oh, papa, I don't believe dose ignorant Americans ever read your speech for dey run after us just like ve vas a lot of rabbits. Vot you tink of dot? Can't you send 'em some of your speeches right avay? Dey don't know how terrible we are. Can't you move my army back to Belgium vere ve von all our glory? My men can vip all de vimmin and children vot dem Belgiums can bring up. But dese Americans are so rough and ignorant. Ve can't make 'em unnerstand dot ve are der greatest soldiers on earth, and ven ve try to sing "Deutschland Uber Alles" dey laff like a lot of monkeys. But ve are getting the best of the Americans. Ve can outrun dem. Papa, if ve are not der best fighters on earth ve sure are de best runners. Nobody can't keep up mit us ven ve tink of der dear old Rhine and my army never did tink so much of dot dear old river. Let me know right avay vat to do by return post office.

Crown Prince Willie.

SYMPATHETIC STRIKE FROWNED ON BY LAW

Wider Application of the "No Strike" Order Is Now Under Consideration

Ottawa.—Wider application of the no-strike order-in-council is understood to be under consideration. Prosecutions so far in Calgary have been taken under the provisions of the Industrial Disputes Investigation Act, which provides penalties for men engaged in certain industries who strike without first applying for a board of conciliation. This course was taken because there was doubt whether the original strike was declared before the no-strike order was approved by the Governor-General.

But, it is pointed out here, sympathetic strikes are in a different category. Any declared since the approval of the order come under its provisions. Not only are the penalties heavier which may be imposed by the civil courts, but the order contains a work or fight provision which may be put into effect. In scope, it goes farther than present applications of the Military Service Act. No married men have been called to the colors under the Military Service Act. The work or fight provision includes all men of military age, whether married or single.

"Any male person, employer or employee of military age as defined by the Military Service Act," reads the provision, "who violates any of the hereinabove enacted regulations and any director of such military age of any company who acquiesces in the violation by the said company by any of said regulations, shall ipso facto be deemed to be a soldier enlisted in the military of Canada and subject to military law for the duration of the present war, and of demobilization thereafter and shall forfeit any exemption granted to him and any right to apply for or obtain any exemption from military service under the Military Service Act."

It is emphasized that there is no desire to cause undue hardship by rigid application of the order-in-council, and hope is expressed that satisfactory settlement will be reached before such a course is rendered necessary.

HALF BILLION IN NEW SHELL ORDERS

Which Means Busy Times Ahead For War Order Shops of the Dominion

Ottawa.—It is officially announced that up to September 30 manufacturers in Canada had produced 68,000,000 shells and 75,650,000 forgings.

The war authorities are making preparations as if there was no peace in sight and orders on a larger scale than ever are being let by the Imperial Munitions Board. The orders for the coming year will run nearly half a billion dollars.

Some Methods of Fighting the Influenza

It Has Always Traveled From East to West, and the Last Scourge Was in 1889-1900—Known as Far Back as 1510—Some of the Things to do if You Feel You Have It

By COMMISSION OF CONSERVATION.

INFLUENZA, which is now sweeping over Canada from one end to the other, is a very old disease. It was known in ancient times, and as early as 1510 it overran the whole civilized world. For centuries it has periodically swept over various parts of the world. The last great world epidemic was in 1889-1890 when it was generally known by the French name of la grippe. The disease has always travelled from east to west.

Symptoms

The symptoms are similar to those of a heavy cold; more or less severe headache, cold in the head and throat, fits of sneezing, flushed face, chills, aches and pains in the back and limbs, pains in the eye-balls and behind the eyes, general physical depression, and temperature rising to between 101 and 104 degrees.

How to Prevent It

As it is such an old disease, doctors have naturally learned a great deal about its prevention and treatment. The first principle of prevention is to keep away from those infected, and the second, to build up the germ-resisting parts of the body by eating nourishing foods, dressing comfortably, getting lots of sleep, and by living in the open air and in bright, well-ventilated rooms as much as possible. The mouth, throat and nose should be systematically and frequently disinfected by antiseptic inhalations, sprays and washes. Such preparations as chloretone and listerine are well adapted for this purpose.

In fighting previous epidemics, doctors found quinine a useful preventive. One grain of sulphate of quinine mixed with (but not dissolved in) a wineglassful of cold water makes an excellent antiseptic gargle. The anti-microbic properties of quinine are well known and its use as described above at once relieves the symptoms of sore throat, which result from the strain of the fight between the white blood corpuscles and the invading germs in the tonsils—the body's first line of defence. Quinine is also given internally with success as a preventive. In one of the more recent outbreaks in Europe, an experiment was tried in which the men of one squadron of a regiment of cavalry were each given 7½ grains of quinine in ½ ounce of whiskey daily for 22 days, whilst those of the other squadrons were given none. The latter squadrons had from 22 to 44 cases each of influenza whilst the squadron treated with quinine developed only 4 cases. Inhalations of oil of eucalyptus, thymol, oil of mountain pine and the like are also valuable as preventives.

How to Treat It

When a person is struck by influenza, only one course lies open. That is to take to bed with the least possible delay, and call a doctor. Rest, warmth and quiet are three sovereign remedies of the primary disease, and the best preventive of its more deadly complications, of which pneumonia is the most frequent. While there is no specific for influenza, yet there are many drugs which play a useful part in relieving it, such as quinine, aspirin and various tonics, anti-neuralgic,antiseptic, and heart medicines, to be prescribed by the physician in charge.

What to Eat

The dietetic rules which apply to any fever apply equally to influenza. Liquid foods at first, solids a little later on in a gradually ascending scale from lightly boiled fresh eggs to chicken, roast joints, etc. Water, cold or hot, may be sipped or "egg water" may be given. This excellent dish is prepared by blending with a pint of cold water the whipped whites of from 2 to 4 eggs, flavored with salt or cinnamon. Then the animal broths may be given. There are many cases in which even the lightest foods are spurned with loathing and common sense must be used in adapting diet to the particular case in hand.

Precautions Against Influenza

(1) The sick should be separated from the healthy. This is especially important in the case of first attacks in the household.

(2) Discharges from the nose and mouth should not be allowed to get dry on a pocket handkerchief or inside the house, office or factory. They should at once be collected in paper or clean rags and burned. If this cannot be done, they should be dropped into a vessel containing water.

(3) Infected articles and rooms should be cleansed and disinfected. Use disinfectants everywhere. Wash the hands frequently.

(4) Those attacked should not, on any account, mingle with other people for at least a period of ten days from the commencement of the attack. In severe cases, they should remain away from work for a longer period.

(5) Special attention should be given to cleanliness and ventilation. Warm clothing should be worn, the feet should be kept dry and all unnecessary exposure avoided.

HOW ONE OF THE LARGE U.S. FIRMS IS FIGHTING THE FLU

FOREMOST among the industries in guarding against the "flu" is the S. F. Bowser & Co., oil tank and pump works, of Fort Wayne, Ind. The officials have organized a health campaign for the benefit of all employes, as well as for the benefit of the city itself. Stations have been installed about the plant buildings which are easily accessible to all, and every employee of the big works is requested and expected to have his or her nose and throat sprayed at least twice daily.

Specially instructed attendants for the spraying are on hand at all times, the service is absolutely free, the company paying the entire expense. Special bulletins have also been posted instructing the men and women on the care of the nose and throat. The influenza germs are in the air in the form of dust and naturally attack through these organs, therefore, every precaution possible should be taken. Spraying of the nose and throat is one of the greatest preventives.

As a further precaution employees have been sworn in as deputy health commissioners with full power to enforce all rules and laws of the health department. It is their duty to take action (drastic, if necessary) to prevent the spread of the disease through spitting, coughing or sneezing, and to report all cases, however slight.

Employees of the factory and office have been instructed to report all cases to the deputies. Any employee showing the slightest symptoms will be sent home immediately. The employes are all responding with a will to the treatments, realizing that everything is being done to insure their health and keep them at their different tasks, which are so essential in the maintenance of the war.

All spittoons of any kind have been removed, as one of the common mediums of transmitting the germs of influenza is through spitting. All employees are also requested to refrain from spitting on the premises.

The Bowser scheme of precaution is a forerunner of similar campaigns which are being inaugurated among the larger plants. Officials of the General Electric Works are devising plans along similar lines.

The Poster Used

The following poster is placed in the Bowser works:

To the Heads of Factories, Managers of Department Stores, and all Institutions where numbers of men or women are employed:

Pursuant to a resolution of the board of health you are hereby ordered to exclude from your workshop, office, or store, everyone suffering from any of the symptoms of a cold. Coughing, sneezing, or a running nose are sufficient cause for sending an employee to his home, where he or she are to stay until these symptoms have disappeared. Refer immediately all violations of health laws to the health deputy in your institution or to the board of health, telephone 715. —E. A. CRULL, Health Commissioner.

Spittoons removed from factory. One of the common mediums of transmitting the germs of influenza in through spitting. It has therefore been ordered, effective Thursday, October 17, 1918, that all spittoons be removed from factory and factory offices. Deputies are charged with the enforcement of the rule that there shall be no spitting anywhere on the premises.

Care of Nose and Throat. The influenza germs are conveyed about in the air in the form of dust and naturally attack through the nose and throat, therefore, every precaution possible should be taken. Spraying of the nose and throat is one of the greatest preventatives. Spraying stations have been located both in the factory and office.

We expect every employee to have his or her nose and throat sprayed at least twice daily, for which no charge is made.

Deputies—Their responsibilities. As a further precaution deputy health officers have been sworn in with full power to enforce all rules and laws of the Health Department. It will be their duty to take any action (drastic if necessary) to prevent the spread of the disease through spitting, coughing or sneezing in public; and to report all cases however slight. The deputies for S. F. Bowser & Company are (a list of twenty names follows):

Employees are requested to report all cases to one of the above. Employees are to be sent home when symptoms appear.—S. F. Bowser & Co., by order Board of Health.

TRADE GOSSIP

Amalgamation in Steel Trade.—The W. J. Crouch Company, Incorporated, and Rownson, Drew & Clydesdale, Inc., announce the amalgamation of their respective organizations. All trading and manufacturing operations henceforth will be conducted under the name of Rownson, Drew & Clydesdale, Inc., with general offices at 68 William street, New York.

In future the name of "Crouch Steel" and all that it implies will be linked with the century old traditions of the house of Rownson, Drew & Clydesdale, which should be a guarantee to their customers all over the world of the highest in "service."

Mr. '. G. Donald, president of Rownson, Drew & Clydesdale, Inc., will continue in this office, while Mr. I. Smullyan, president of the W. J. Crouch company, Incorporated, will act as managing director of the new firm.

Messrs. Victor E. Karminski and A. E. Hearne, both treasurer and general manager of the W. J. Crouch Company, Incorporated, and Rownson, Drew & Clydesdale, Inc., respectively, will in future act as joint general managers of the new concern, Mr. Karminski conducting the Crouch Steel Division, and Mr. Hearne directing all other trading operations.

Mr. H. Lad Landau, assistant secretary and general manager of sales of the W. J. Crouch Company, will continue wit hthe new concern. So will other leading officers of the company, such as Mr. John H. Allen, purchasing agent, who will in the future be assisted by Mr. M. Greenberg of Rownson, Drew & Clydesdale, Inc.; Mr. Albert Smullyan, comptroller; Mr. O. W. Andrews, traffic manager, and head of the company's licensing bureau, and all others occupying positions of trust with the old companies.

CATALOGUES

The United States Silica Co. have recently issued a descriptive booklet of their various products enumerating the excellent qualties of flint shot and illustrated by a number of excellent drawings, which effectively drive home its advantages. Flint shot is extremely hard and effects a considerable saving in freight, air and labor, and may readily be used on castings of any material, forgings, stampings, hot rolled bars or sheets.

The Armstrong Cork and Insulation Co., Pittsburg, describe their nonpareil high pressure insulation in a booklet recently issued. The desirability of minimizing the loss of heat from steam drums, feed water heaters, internally fired and locomotive type boilers, enamel and japan baking ovens' tanks, breechings, etc., has long been recognized. The advantages of nonpareil insulation for these purposes is dealt with and the reason for its excellence as a heat insulation explained. Its applications to various industries is shown in the half tone illustrations of typical installations.

In Bulletin No. 104 the University of Illinois have published the results of an investigation undertaken to determine the rigidity of riveted joints in steel structures and valuable data have been secured. Tests were made on full-sized members with different connections. The distribution of the stresses in a rectangular frame depends upon the rigidity of the connections. In analyzing the stresses in such a frame it is customary to assume the connections are perfectly rigid. If they are not, it is apparent that the actual stress may not be equal to the computed stress. In addition to determining the rigidity of riveted connections, analyses have been made to determine the effect of lack of rigidity upon the distribution of stresses in a frame.

The Armstrong Cork and Insulation Co. have issued a descriptive booklet dealing with their lineotile floor covering. The floor problem is always a vexing one. Nowhere is it more troublesome than in offices, banks, stores, church lobbies and places of similar character. Similar problems present themselves in the floors of certain rooms in private residences such as billiard rooms and kitchens. To meet need of a floor which would be suitable for such requirements this company has brought out the Linotile floor, a covering which fulfils the requirements of resiliency, silence, warmth, sanitation, durability and cleanliness at a reasonable cost. The various uses of the flooring are described, its advantages explained and numerous illustrations in color give a good idea of its attractiveness and adaptability to varying architectural requirements.

The Defender Regulator Co., Saint Louis, describe their various instruments for use in the efficient operation of the boiler room. In view of the necessity for conserving fuel literature on apparatus of this type is of special interest at the present time. Complete control boards are illustrated and draft gauges, vertical pressure and vacuum gauges, pyrometers, thermometers and complete gas analysis apparatus are listed and described in detail. Information is given on the proper location and use of instruments of this type and a sample boiler room report sheet is illustrated, which the company supply. This latter is an excellent means of recording detail operations in the boiler room, gas analysis and draft pressures.

Raised Them Himself

Food Controller Hoover told at a meatless-wheatless banquet a story about a poultry profiteer.

"A lady entered his shop," said Mr. Hoover, "and asked the price of chicken."

"'Them birds in the winder,' said the profiteer. 'Waal, they're very fine quality stock. I can't let 'em go for less than 94 cents a pound.'

"'Indeed!' said the lady. 'Did you raise them yourself?'

"'Yep', said the profiteer, absently. 'They were 70 cents yesterday.'"

How She'd Changed

"It looks as if Jones is better satisfied with his wife."

"Yes, he is. You see, he went back home on a visit and saw the girl he had been dreaming of for the past twenty years."—Life.

Not Necessarily

"'One wife too many!'" exclaimed Mrs. Wederly, as she glanced at the headlines of her husband's paper. "I suppose that is an account of the doings of some bigamist?"

"Not necessarily, my dear," replied her husband, without daring to look up.

Great Importance Of Buying Good Pig Iron

If it is Too High in Sulphur or Too Low in Phosphorus Trouble Will Follow Its Use—Fine Grades For Strong Castings Require a Careful Analysis

By E. STANDIFORD

WHEN you require a good clear pig iron, free as possible from dross, kish, oxide, sand, etc., the following analysis will be found an excellent grade. The percentage of "sows" must never vary to any great extent from the usual amount found in a strictly graded iron, according to the old fracture method.

Analysis of Foundry Pig Iron, No. 1

	Per Cent.
Silicon must not be less than	2.50
Sulphur must not exceed	0.03
Phosphorus should not exceed	0.60
Manganese should not exceed	0.50
Total carbon not apecified.	

The carbons will usually be between 3 and 4.50 per cent. in this grade. Any No. 1 foundry pig which shows on analysis less than 2.40 per cent. of silicon or more than 0.035 per cent. of sulphur should be rejected.

Foundry No. 2

	Per Cent.
Silicon must not be less than	1.95
Sulphur must not exceed	0.04
Phosphorus should not exceed	0.70
Manganese should not exceed	0.70
Total carbon not specified.	

The carbons in No. 2 will generally range from 2.90 to 4.20 per cent. Any foundry pig No. 2 which shows on analysis less than 1.85 per cent. of silicon or more than 0.045 per cent. of sulphur should be rejected.

Foundry Pig No. 3

	Per Cent.
Silicon must not be less than	1.35
Sulphur must not exceed	0.05
Phosphorus should not exceed	0.80
Manganese should not exceed	0.90
Total carbon not apecified.	

The carbons of this grade will usually be between 2.50 and 4 per cent.; if No. 3 shows on analysis less than 1.25 per cent. of silicon or more than 0.055 per cent. of sulphur, it should be rejected. All grades of pig iron should be bought by analysis instead of by fracture; you should mix by analysis in the foundry, and the pig iron should necessarily follow the specifications; furthermore, if you accept as No. 2, which fails to fill the No. 1 conditions, you might eventually be overstocked with No. 2 and be unable to get the results aimed at in the cupola mixture; consequently an iron sold as No. 1 or any other grade should be rejected if not strictly within the specifications for said grade.

Test the Pig Iron

When a car of pig is received, it should be immediately sampled by an experienced man (professional sampler) who could select a certain number of pigs from different parts of the car which according to his judgment shall represent the average quality of the iron; these pigs should be broken and drillings from the face of the fracture should be sent to the laboratory for a chemical analysis; this analysis will decide the acceptance or rejection of the iron.

In case of dispute the furnace or the seller should have the right to re-sample the iron in conjunction with the buyer, each to select five pigs. Drillings from ten pigs, after being well mixed. could be divided into three different samples, one lot to be analyzed by the furnace, one by the laboratory and one by a disinterested chemist agreed upon by the parties in dispute. The two analyses nearest alike could then be accepted as the proper chemical composition of the iron.

Methods To Be Used

The following chemical methods could be used in the laboratory, viz.:

Silicon—Drown's method.

Sulphur—Evolution and titration with iodine (volumetric) as a rapid method, and the oxidation method (gravimetric) in all cases of dispute.

Phosphorus—Emmerton's method for rapid work and the molybdate magnesia method for very accurate determinations.

Manganese—Deshay's or the colorimetric method for rapid work and the acetate process for extremely accurate work.

Carbons—Carbons are worked generally by the colorimetric and combustion methods. In case of dispute analyses could be made by gravimetric methods.

Silver Gray (S. G.) or Silicon Pig

In the following analysis you can expect a pig iron medium high in silicon and not too low in graphitic carbon; this can be used as a softener.

	Per Cent.
Silicon must not be less than	3.00
And should not be more than	5.50
Sulphur must not exceed	0.04
Phosphorus should not exceed	0.90
Manganese should not he less than	0.30
Total carbon should not be less than	2.50

Any car of S. G. iron which shows on analysis less than 3 per cent. of silicon or more than 0.055 per cent. of sulphur should be rejected.

Ferro-Silicon Pig Iron

This is a specification of a pig iron with 8 per cent. silicon; the general range for silicon in this grade is from 6 to 12 per cent.

	Per cent.
Silicon must not be less than	7.00
Or not more than	12.50
Sulphur must not exceed	0.04
Manganese not specified.	
Carbon total not specified.	

As a rule the graphite carbon would be low, carrying from 3 to 0.50 per cent. Manganese may occasionally vary from 0.20 to 3 per cent. or more. Cars should be rejected which show less than 6 per cent. of silicon or more than 0.045 per cent. of sulphur.

Manganese Pig (Manganiferous Pig)

	Per cent.
Silicon should not be less than	2.50
Sulphur must not exceed	0.04
Phosphorus should not exceed	0.70
Manganese must not be less than	0.90
Carbon not specified.	

In this specification you get an iron from 1 to 2.50 per cent. manganese; the ordinary No. 1 pig iron running about 1.50 per cent. in manganese would fill all conditions required; as a rule higher the manganese the greater the proportion of combined carbon; combined carbon may range from 0.30 to 3 per cent. while the graphitic carbon may vary from 0.40 to 3.50 per cent.

I will now make a few remarks on manganiferous irons which may help to define the dividing line between the ordinary foundry pig and the regular manganese iron. Manganese pig is an ordinary iron made from ore containing somewhat more manganese than the regular foundry irons; it will run from 0.80 to 3.50 per cent. in manganese; it is added to foundry pig, in cupola practice, to raise the combined carbon, thereby increasing the strength. In a measure it neutralizes the effect of sulphur, removes excess of gas and prevents blow holes; it must be used with caution, as a low silicon and carbon, with high manganese, gives hard iron and alters the shrinkage; spiegel iron is used mostly in steel making, it is supposed to contain from 10 to 25 per cent. of manganese, but some authorities place the range from 3.50 to 20 per cent.

Ferromanganese contains from 25 to 90 per cent. of manganese; most of the ferromanganese on the market runs about 80 per cent. of manganese. With 80 per cent. of manganese present there is not much room for iron; the metal however, usually contains sulphur, phosphorus, carbon and silicon.

In cupola practice the amount of ferromanganese used is generally very small, consequently the effect of the other metalloids is not great. Manganese has a tendency to keep the carbon in the combined form; hence it lowers the graphitic carbon, thereby reducing the deflection; it neutralizes the effect of sulphur by reducing red shortness, and indirectly offsets the cold shortness or brittleness caused by high phosphorus.

In foundry practice the more manganese present in the pig the more silicon and graphitic carbon required to produce soft castings. For "chill mixtures" where great toughness is required, a pig with 2 per cent. manganese and less than 1 per cent. silicon is a desideratum.

Malleable Bessemer Pig

This specification will cover both the "common" and "straight" malleable Bessemer; when the straight Bessemer is specified it is understood that the phosphorus is not to exceed 0.10 per cent. straight Bessemer with 1 to 1.50 per cent. of silicon, about 0.60 per cent. manganese, under 0.11 per cent. phosphorus and below 0.04 per cent. sulphur would be satisfactory; in common Bessemer the following limit is specified:

	Per cent.
Silicon may range from	0.70 to 2.10
Sulphur must not exceed	0.045
Phosphorus must not exceed	0.15
Manganese may range from	0.30 to 1.20
Total carbon should not exceed	3.75

As a rule the combined carbon will vary from 0.30 to 1.30 per cent. and the graphitic carbon from 3.45 to 1.80 per cent. The iron should be rejected if the analysis shows more than 0.05 per cent. of sulphur or more than 0.18 per cent. of phosphorus.

Phosphoric Pig Iron

Phosphoric iron is used almost exclusively for small, thin castings, where great fluidity is desired; a very fluid iron is essential in thin work, as it fills every part of the mold and gives a clear, solid casting. Iron high in phosphorus is very weak and brittle under impact (shock) consequently it cannot be used where great strength is required; with high silicon and a high graphitic carbon the phosphorus may rise to 1 per cent. in the casting, but in chilled work, with low silicon and much combined carbon, the phosphorus must be kept below 0.30 per cent.

	Per cent.
Silicon must not be less than	1.50
Sulphur must not exceed	0.055
Phosphorus must not be below	1.00
Manganese may range from	0.30 to 0.90
Total carbon should not be below	3.00

Any car of iron which shows upon analysis more than 0.06 per cent. of sulphur or less than 0.90 per cent. of phosphorus should be rejected.

CONTROL OF COOLING IN CASTINGS

By D. STREET

For preventing the difficulties and defects that arise from the uneven contractions of irregular masses of metal for casting, Mr. Cecil Greenhill, Gloucester, has patented a method which depends on the application of electric heat to the thinner and less dense parts of the castings, with the object of keeping their falling temperature the same as those of the thicker and dense parts. As the method of application he suggests casting runners or ribs on the thinnest section and applying heat electrically by dropping electrodes in the molten metal and allowing the preliminary cooling to 1,300 degrees C. to make the joint. In cooling the thinner sections cool more rapidly than the thick ones, but if an electrical current is passed through more heat will be developed in the thinner ones because they have greater electrical resistance than the thicker ones. The amount of current required would not be as large as might appear at first sight, since only losses of heat have to be replaced. It would, therefore, not be anything so great as would be required to heat bodies of metal up to the temperatures at which they are treated, and it would be designed merely to keep the thinnest portions at the same falling temperature as the thickest ones. The method of procedure might be varied so that the current might be used either through the whole range of temperature in cooling or through portions only. In the case of steel it need perhaps be applied only at critical periods of steel formation, say, between 1,300 and 1,050 deg. C., after which the casting might be allowed to cool naturally without harm. Or the casting might be kept at 1,050 deg. and in shapes where the mould could be stripped the mould might be removed and the casting placed in the annealing furnace, thus saving reheating to this temperature for annealing.

His Excuse

It was the middle of the week when the young man appeared at the office to make his excuses and explanations.

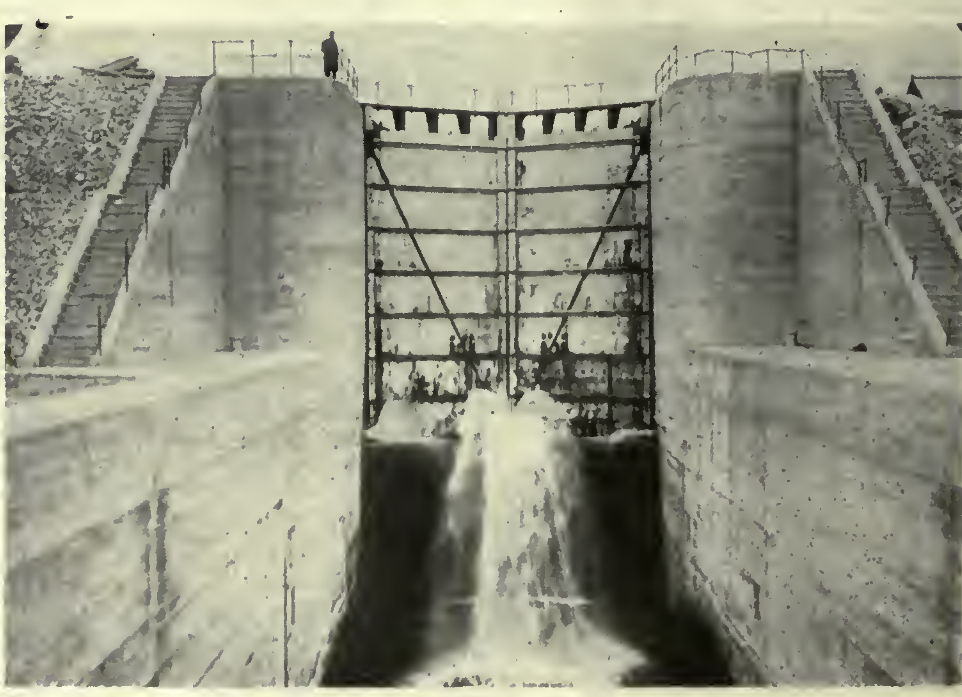
"You should have returned from your vacation last Monday, sir," said his employer. "You were having a good time at that summer resort, I suppose, and thought you were entitled to three days of grace."

"N-not exactly," stammered the young man, with heightened color. "Laura, sir."

Current Events in Photograph

LOCKS ON THE TRENT CANAL

Picture shows the upper lock of the Trent Canal at Hailey's Falls, Ont. The lift here is 27 feet. The canal has only recently been placed in operation, and connects Peterboro and Trenton. Further work is in progress which will make it one of Canada's most important waterways.



THE STEERING OF SHIPS

By M. M.

All ships must possess the power to manœuvre, but exactly to what extent will depend on the type of the vessel and the use for which it is intended. Although all vessels possess the power to manœuvre it can hardly be said that the majority of ships are really easy to handle. It is true they are handled and handled effectively, but nevertheless captains often wish that they had more control over their vessels than is given them even by twin propellers and the ordinary rudder.

It will not be without interest to examine what takes place when helm is given to a ship. As the rudder at first goes over, the ship for the moment continues on her course and there is a sudden concentration of water between the rudder and the deadwood aft. This sets up an increase of pressure on both the rudder and the deadwood which pushes away the stern of the ship in the opposite direction to which the rudder is turning. The ship also moves bodily outwards. The instantaneous effect therefore is to move the ship along a course which is curved in the opposite way to that in which the ship is required to turn finally. In a short time the ship takes up a definite, but not really steady swing. This swing is helped by the pressure on the bow, the excess pressure on the deadwood aft being reduced. Shortly after this the vessel settles down to a steady swing, the pressures on bow and the rudder turning her, but the pressure on the deadwood aft is now on the opposite side to what it was originally, with the result that it retards the turning of the vessel. Equilibrium must eventually be established when the middle line of the ship takes up a definite angle to the direction in which the centre of gravity of the ship is travelling. This angle is called the drift angle. The distance between the original course of the vessel and the position of the ship when she is moving in exactly the opposite direction to her original one is called the tactical diameter of the vessel. If this is to be small the deadwood aft should be well cut away.

When the ship settles down on her turning circle, about the centre of which she rotates, there is some point—usually well forward of amidships—on the vessel which only has a motion along the middle line, every other point on the vessel really moving in some other direction. This point is called the pivoting point, and the resistance of the various parts under water to turning depend on their distance from this pivoting point. Since the pivoting point is forward of amidships, it follows that the aft deadwood is more effective in reducing turning than the forward deadwood.

When the rudder is first put over, the centre of pressure on it is below the centre of pressure of the force opposing the lateral motion of the ship, and in consequence the vessel at first heels towards the centre of the turning circle. When steady motion is established, centrifugal force acts on the vessel through a point generally above the water line and certainly above the centre of lateral resistance. This force is more powerful than the pressure on the rudder, with the result that the vessel heels outwards. Although this is very generally true, it would be possible to conceive of a case where the pressure on the rudder was so great and relatively high, and the centre of gravity of the ship, through which the centrifugal force acts, so low, that the ship might heel inwards on the turning circle instead of outwards.

It is, of course, well known that wind will affect the steering of a ship. If she is moving with the wind on the beam, the centre of pressure of the wind force on the above-water portion may be forward of abaft the centre of lateral resistance of the under-water portion. In any case, helm will have to be carried one way or another to correct the tendency of the wind to turn the ship. This will always decrease the speed of the vessel. In one particular case, it so happened that the centre of pressure of wind was abaft the centre of lateral resistance, the deadwood aft was cut away, bringing the latter point further forward, making matters worse, so that a good deal of helm had to be carried with a beam-wind.

It is generally understood that wind can affect the speed of a ship a good deal. If the wind is directly ahead, it will retard the motion of a ship considerably by direct pressure, although it will not affect the helm. If it is on either bow, it will not only retard the speed on account of its direct pressure, but also by the fact that helm will have to be carried to keep the vessel straight. With wind directly on the beam, helm will always practically be carried, and the speed of the ship will be retarded on this account, although the wind pressure has no direct effect.

Rudders are divided into several classes. The most common form is the ordinary merchantile rudder in which the whole area of the rudder is abaft the axis of rotation. For many years the most common type of rudder in war vessels has been the balanced rudder. This takes several different forms. It may be completely balanced and supported by the rudder head and a bottom pintle, or it may be completely balanced and also completely underhung and supported from two points on the rudder stock. There is another form of rudder described as semi-balanced, in which a small portion only of the rudder area is forward of the axis, the rudder being pivoted on the rudderhead and on one or more pintles, the portion of the rudder below the bottom pintle being completely underhung.

The ordinary mercantile form of rudder in general use because it is easily handled, although it is not so economical in form as some of the other types speeds of merchant vessels being generally small does not make the rudder unmanageable in size. The steering gear for it has to be larger and heavier than the more effective rudder of the balanced or semi-balanced type, all of its area being abaft the axis, the twisting forces acting on it are much greater than with the latter type. For vessels with cruiser sterns — which includes practically all war vessels—the balanced type of rudder becomes almost a necessity, although in the last few years certain merchant vessels fitted with cruiser sterns have still been given the ordinary merchant type of rudder, and it is doubtful if there is any reason to depart from this form in general practice. If particularly rapid manoeuvring is required there may be some reason for it.

There is not a very accurate way of working up the strength of rudders from first principles, as the forces acting on them have never been very accurately determined. Formulæ are used for this purpose in certain cases which are admittedly comparative. For the majority of merchant vessels the necessary rudder sizes are all given in the rules of the registration societies. It can hardly be said that a rudder is particularly effective in controlling a ship, in fact, if specially delicate manoeuvring is required in a vessel, twin screws must always be fitted to assist the rudder.

REPAIRING A LINE SHAFT

By A. L. Haas.

Although naturally unacquainted with the precise circumstances or nature of the fracture it looks as though the emergency repair described by J. H. Houldsworth on page 243, August issue was unduly complicated. Moreover, the repairs as described weakened the shaft and unless a very large factor of safety was present, it is probable that the repair would not have held.

In one classic instance of fracture to a steamer's propeller shafting, the ship was worked into port by coiling chain round the fracture, more to camoflage it than for any other reason, the break was very oblique and allowed ahead working at slow speed.

Faced with the conditions outlined in the sketch in the article in question, and presuming that the fracture was not a dead square parting of the shaft, a simpler artifice involving much less labor, is open as a temporary expedient.

A pair of shaft couplings can be mounted on the break if available, cutting the key ways is not a long job, a smith made clip of plate would probably serve to restore running conditions without keying at all, if made in any usual manner.

Solid drawn tubing, if available, and from saddle keys each end would, if the shaft were small, provide another alternative. A pulley boss or pulley complete would have served. A pair of shafting collars could also be impressed into service, the obliquity and inherent roughness of the break providing the drive.

In short it seems to the writer that the method chosen shews a want of resource which impaired the shaft strength by about 30 per cent and is by no means a commendable means of temporary fixing. It must have taken at least a day's work to effect.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 32 00	$ 29 50
Electro copper	32 00	29 50
Castings, copper	31 00	28 50
Tin	100 00	95 00
Spelter	10 75	11 00
Lead	10 50	10 00
Antimony	16 00	18 00
Aluminum	50 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 37

Standard Buttweld

Per 100 feet	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

Terms 2% 30 days, approved credit.

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

Prices—Ontario, Quebec and Maritime Provincea.

WROUGHT NIPPLES

4" and under, 45%.
4½" and larger, 40%.
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	30 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

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Discount off list, Montreal and Toronto	net

CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

Vol. XX. TORONTO, OCTOBER 31, 1918 No. 18

EDITORIAL CONTENTS

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INDEX TO ADVERTISERS

CANADIAN MACHINERY AND MANUFACTURING NEWS

October 31, 1918. Volume XX. No. 18.

BY buying Victory Bonds you are performing a greater service to yourself than to your country. As an investment it is the best thing the small investor has a chance to buy. It is safer than a bank, and more secure than a first mortgage. The revenue from these bonds is not taxed.

Shop Organization for Handling Victory Loan

How the Massey-Harris Co. of Toronto Have Handled the Advertising, Selling, Collection and Delivery of Bonds—What is Being Done in Other Industrial Centres of the Dominion

THE Massey-Harris Co. of Toronto, for the purpose of organizing for the Victory Loan campaign in their shops here, hark back to the days of the Old Testament, and estimate that one-tenth of his earnings is a fair amount for a man to put into Victory Bonds in the present great drive. At least that is the objective they set up. There is no compulsion about the matter. Mr. Leo S. B. Smyth, secretary of the Victory Loan organization in the Massey-Harris Co., discussing the matter with CANADIAN MACHINERY, stated: "We do not force men into the purchasing of bonds, and where a man has good reasons for not buying, we do not press the matter any further. But where we know that a man is in a position to buy, why our canvassers go straight for him and do their best to make a sale."

The Massey-Harris Co. have been through the Victory Loan business before, and know just about what is good and bad in the various systems of shop organization that have been tried out. They sold some $150,000 worth of the last loan in their Toronto shops. Including the works in Brantford and Woodstock, the total would run over $250,000. This does not include the subscriptions of any of the officials or directors of the company. The system they made use of is being used by several other manufacturers for the handling of this campaign, and officials of the company are quite willing that any part of their system, as outlined here, should be made use of by any company handling the sale of Victory Bonds to their employees, and undertaking to extend payments and make collections.

The Advertising Campaign

Some days ago the advertising campaign was started. All the posters that could be secured were hung up in the shops, and everything possible was done to bring the campaign to the attention of the employees as often and as forcibly as possible. Literature explaining the loan and the nature of the security provided was also given out. Along King street, where the works are located, bulletin boards were used freely with some of the campaign material prominently displayed. Everything possible was done to make it the topic of conversation and of chief interest all through the works.

When the employees were going out at noon and in the evening they were handed little cards bearing messages pertinent to the campaign. These were changed frequently, so that the men would not become accustomed to thinking that they had seen the thing before, and therefore pay no attention to it. Here are some of the messages on these cards. They were 2¼ inches by 4 inches, in two colors, red and blue:

WHAT IF PEACE SHOULD COME?

Whether we have an early peace or not will make no difference as to the need of the money to be raised by the Victory Loan, 1918.

Should peace come it will still be months before Canada's soldiers can be brought back and demobilized, during which time they will need food and clothing. Then there is the expense of transportation and demobilization—so let us still stick to the boys—buy Victory Bonds.

DUTY WITH AN OPPORTUNITY

It is our duty to back the boys at the front with our money. The Victory Loan gives us an opportunity to do so, and at the same time secure a safe investment at good interest—Make a loan or be alone.

Privileges in a free country always carry with them obligations. Buy Victory Bonds and secure freedom not only to the present generation but to posterity. Bondmen now—Freemen for ever.

Upon the success of the Victory Loan of 1918 depends not only the maintenance of Canada's military effort overseas, but also the continuance of national prosperity. On both patriotic and personal investment grounds, Victory Bonds should be purchased to the limit of ability.

Application for Canada's Victory Bonds—Interest 5½%

Conditions:

Bearer Bonds

Fully Registered Bonds in name of

No.

Street

P.O.

x 50	5-Year, $
x 100	5-Year, $
x 500	5-Year, $
x 1000	5-Year, $
x 50	15-Year, $
x 100	15-Year, $
x 500	15-Year, $
x 1000	15-Year, $
	TOTAL, - $

Payable

$ .... Weekly
$ .... Bi-Weekly
$ .... Monthly
$ .... Cash Down

103 3m 10-18

OCTOBER 28, 1918.

TO MASSEY-HARRIS CO., LIMITED.

I, the undersigned, desire to invest in Canada's VICTORY BONDS to the value of and according to Terms of Payment and other conditions set forth in left margin of this Application. I authorize you to reserve from my Wages or Salary the various instalments as they fall due as well as any Payments of Interest to the Dominion Government or Banks for carrying my Bonds, if such there be. I have the right to pay the remaining instalments at any time and receive my Bonds forthwith.

Name ....

Street No. ....

Street ....

Post Office ....

Check No. ....

Witness ....

REMARKS:

Cash paid to Canvasser, $ ....

FORM USED IN SECURING APPLICATION FOR SUBSCRIPTIONS TO VICTORY LOAN IN MASSEY-HARRIS SHOPS

Table showing Amounts and Due Dates for each $100 Bought on 10-Payment Plan

PAYMENTS DUE	AMOUNT DUE
With Application	$10.00
Dec. 1, 1918	10.00
Jan. 1, 1919	10 00
Feb. 1, 1919	10.00
Mar. 1, 1919	10.00
Apr. 1, 1919	10.00
May 1, 1919	10.00
June 1, 1919	10.00
July 1, 1919	10.00
Aug. 1, 1919	9.50

Amount of Payments,		$99.50
Credit Interest Coupon May 1st,	2.75	
Less Bank Interest	2.25	.50
TOTAL		$100.00

BACK OF FORM USED BY MASSEY-HARRIS CO., SHOWING HOW EXTENDED PAYMENTS ARE HANDLED.

The Shop Organization

"We have the organization all complete here," stated Mr. Smyth in discussing that part of the campaign. "The Toronto shop is divided into districts, according to the departments. We try as nearly as possible to have about two hundred men in each district. The plan used here is to divide on these lines, or as nearly so as possible:

Machine shop.
Steel department.
Woodworking shops.
Molding shops.
Packing and shipping.
Painting shop.
Printing department.
Knife and grinding.
Yard forces.
Office staff.

Each of these districts has a captain. This year the following are the leaders: J. G. Hossack, A. M. Rae, D. B. MacPherson, A. E. Shields, F. W. Hunt, J. N. Patterson, J. T. Orr, J. B. Warnock, George White, Leo. S. B. Smyth. Mr. Smyth, as well as being a district captain, has charge of the whole of the campaign in the Massey-Harris shops in Toronto.

How Campaigning Helps

On Monday, October 28, meetings were held in all the various departments. The factory whistle blew at nine o'clock, and meetings were held at ten different points. After that the campaign was considered as started. Here in brief is the attitude of the company in the matter as explained in some of the leaflets that were handed around the shop:

"In order that as many as possible of the Massey-Harris employees may take advantage of the opportunity to invest in Victory Bonds, the company has arranged to supply them to its employees and extend the payments over ten months.

"This makes it possible for almost everyone to buy a bond, as the payments are made so light they will never be missed.

"Should any employee adopting the above plan find it necessary to leave the employ of the company before the bond is fully paid up, he can either: Pay the balance and receive his fully paid up bond. Continue to make payments to the company as specified. If unable to continue the payments you can readily sell your bond.

Instructions to Canvassers

The following instructions have been prepared and are handed to the canvassers:

1. Work from this list and call on every man.
2. Supplementary list of new men added to payroll will be issued.
3. If purchaser is paid from the head office say monthly or weekly in place of check number.
4. Payments will be deducted from Mr. Powell's pay roll in first pay of each month. Those paid by Mr. Kelly will settle at Victory Loan desk in office.
5. Take all money offered and show amount under remarks. Have men bring cheques if convenient. If they draw on their bank account a cheque can be gotten.
6. Put daily totals of cash collected in space above and receive receipt.
7. If a man buys a bond for cash try and sell a second one on time.
8. Give every purchaser a button when application signed.
9. Try and sell bonds for cash to Chinese.
10. Endorse cash received in column number one on other side this sheet, also show amount of subscription in first column to right of name. Second and third sales (if any) go in second and third money columns to right of name. Add subscriptions and report to blackboard in cafeteria at noon each day.
11. Come to the lunch at cafeteria daily.
12. "Every man a bond."
13. "Every girl a bond."

The "list" referred to in the above list is a list of all the men employed in the works. It is prepared from the payroll and shows the check number, name, subscription, and the amount of cash paid to the canvasser. An estimate is made from the pay roll and it is figured on a ten per cent. basis how much each department should buy, and that amount is made the objective.

Means a Lot of Work

"We had 1,200 ledger accounts in the office here from the last campaign," stated Mr. Smyth, "and counting the other branches there must have been 2,500 accounts in all. The clerical work made it necessary for us to engage an accountant to look after this. We do not make any offers to the effect that the company will take the bonds over if the men do not want to finish the payments.

Dominion of Canada
WAR LOAN BONDS

*Pay Roll No.*__________

*Name*__________

*Address*__________

____

DATE BONDS DUE__________

Particulars

Bonds @	$ 50.	**Numbers**______
Bonds @	$ 100.	**Numbers**______
Bonds @	$ 500.	**Numbers**______
Bonds @	$ 1,000.	**Numbers**______

Information

These Papers are valuable and should be put in a place of safety.

Interest is Payable June 1, 1918, and each six months thereafter.

Interest Coupons are to be detached from BEARER BONDS and cashed at any Bank.

Owners of REGISTERED BONDS will receive their Interest by Cheque direct from Ottawa. They must remember, however, to send any change of address to, **Dept. of Finance, War Loans, Ottawa, Ont.** Better do so by Registered Letter. No Postage required.

If necessary to sell, it is best to deal with a responsible Broker.

MASSEY-HARRIS CO., Limited.
TORONTO.

1913 15c 5-18

THE ABOVE IS PRINTED ON A STIFF MANILA ENVELOPE—A GOOD PLACE TO KEEP THE BOND.

We do not encourage buying with a string attached to it. On the other hand we always try to deal as fairly as possible in the matter. If we find that a man has had considerable time off in any one pay, it is easy to see that he cannot stand to have his allowance taken off of that again, and an extension is given to him. The company will do all in its power within reason to help an employee hold on to his bond, but we will not go in on the understanding that we will take it off his hands any time he feels like dropping it. Much of this is explained in the material given out to the employees. In case of sickness or hardship the same rule applies, and an extension is granted to meet the case."

The payments are deducted from the pay envelope, and in place of the amount deducted a receipt for it is placed in the envelope; this has been found to be the most satisfactory method of handling this work. In some cases the card punching system was used, but this was not nearly as satisfactory, as it was necessary for the men to stand in line and generally wait quite a while for their turn to come.

The Massey-Harris organization has been complete and ready for some days, and nothing remained in the way of detail—except going ahead and selling the bonds. Although the officials are not mentioning any figures in advance, they are confident of an excellent showing for this great industrial plant in Toronto.

The Russell Motor Car Aiming at $250,000

Shop Has Been Divided Into Districts and the Canvassers Have the Situation Well Cleaned up Now—Little Booster Paper Makes Its Appearance in the Works Every Day

ORGANIZATION has been completed at the plant of the Russell Motor Car Co., for the selling of Victory Bonds to the employees there. The firm is setting up a quarter of a million as the objective, and they are putting on a campaign that has enough pep in it to clear up on the situation in a day or so. Three shifts are working there all the time, and on that account it is necessary to have more workers than in many other places.

The firm is issuing a diminutive paper every day, called the "Russell Victory Loan Booster." From the "Booster" we take the following concerning the shop organization:

We Go At It

"We," not the ordinary "we," but really "we"—us, the people—had a rousing good time in the Shell Shipping Room on Friday afternoon, when the Victory Loan campaign received its kick-off.

The general manager, Mr. Russell, rushed from the annual meeting of the shareholders and was right at himself in a ripping ten minute talk on the need for a Victory Loan, the meaning of a Victory bond and the duty of the Russell employees in buying Victory bonds. There was really nothing left to be said when he got through that hot talk.

Nevertheless, our old friend Boss Burt from Buffalo managed to throw in some hot bricks as to the pace set by the Russell employees over the line.

Chairman MacKay at once suggested that if the Russell people in Buffalo took a week to raise an average of $100.00 per head, the Russell employees in Canada, having been in the war four years longer than the Yanks, could obtain the same objective in two days.

The suggestion that the "Honor Flag" will fly from the Russell masthead, King and Dufferin streets, Toronto, Tuesday night met with a hearty response. After giving cheers for the boys and the Loan, and the singing of the National Anthem, the crowd went back to work with a resolve that the $100.00 per woman and man average was a sure thing.

Our Organization

General Committee.—Fred Adams; T. Yellowley; G. Ellis; F. Bavington; A. Bowman; N. Graham; J. W. Widdup; J. F. MacKay, chairman; G. W. Suggitt, secretary.

Speakers' Committee—Mr. MacKay; Mr. Yellowley, and Mr. Ellis.

Publicity—Mr. Widdup.

Entertainment Committee—Mr. Bowman; Mr. Maltman; Mr. Suggitt and Miss Moore.

Department Committee—Shell: Messrs. Dusty; Hannah; Gerbig; Marks; Davis; Hunt; Stephens; Williams; Curtis; Thomas; Ducker; Barry; Arnold.

Fuse: Messrs. Clark; Othen; Spence: Hicks; Corbett; Burkhart; Morang; Burns; Christie; Richardson.

Tool: Messrs. Bowman and Dawson.

Millwright, Stores and Carpenter Departments—Mr. Graham, Mr. Stewart, Mr. Sorensen and Mr. Brown.

Engineering Department—Mr. Thompson.

Government Inspection—Fuse: Mr. Freedman. Shells: Mr. Dolson.

Office—General: Mr. Widdup. Time: Mr. Gartshore.

Machine and Stamping — Mr. Whyte, Mr. Smith and Mr. Kay.

General Manager's Appeal

The following is the appeal made to the employees by T. A. Russell, vice-president and general manager of the company:

Since the first year of the war the wheels of our factories have been kept turning almost continuously, producing munitions of war on a scale never dreamed possible in Canada prior to the outbreak of hostilities. When the last Victory Loan was offered for subscription in this country the employees of the Russell Motor Car Company took a place among the first half-dozen industries of the country in the percentage of employees subscribing for the bonds.

In view of all that has happened during the past year—the indescribable sacrifices made by our men at the front, the glorious victories they have achieved, coupled with the continuous employment and comfortable conditions under which we have lived—is it too much to expect that every employee of our company will subscribe for one or more Victory bonds? Would it not be a record in which each one of us would feel a measure of satisfaction in the years to come to know that at least to this extent we lent our aid in the defeat of the Huns?

The money already loaned by the Canadian people to the Canadian Government in the form of Victory bonds has made possible the carrying on of the ordinary affairs of the Government as well as the financing of the huge munition orders throughout this country. For the twelve months ending March 31, 1918, Canadian manufacturers exported over $636,000,000 worth of merchandise, an increase in three years of $551,000,000, or 648%. $20,000,000 per month has been advanced to the Imperial Munitions Board at Ottawa for the purchases of Great Britain in this country, and there has also been expended approximately $20,000,000 a month for other war purposes in Canada.

In one sense it does not seem proper to call a subscription to a Canadian Victory Loan a work of patriotism, for it is in reality a sound business transaction. The bonds are offered at par and interest at 5½%. The amount of the loan the Government is asking for is $300,000,000, but it is hoped that, as has been the case with former Canadian loans, the amount will be very largely over-subscribed. The bonds mature in 5 or 15 years, as desired by the subscriber, and may be converted into any future domestic issues of like maturity or longer made during the remaining period of the war. The bonds will be issued in denominations of $50, $100, $500 and $1,000. The bonds are exempt from taxes, including any income taxes imposed in pursuance of legislation enacted by the Parliament of Canada. The terms of payment are: 10% on application; 20% on December 6th; 20% on January 6th; 20% on February 6th, and 31.1/6% on March 6th; or 100% flat, on application. The selling campaign will open on October 28th and close on November 16th.

The world is watching Canada. Our money is required for the proper prosecution of the war, but, beyond this, there is great moral need of it. Is the spirit waning that has made possible the incomparable deeds of heroism on the part of Canada's men in France and Flanders? We believe not, but each one must answer for himself and herself.

An "Honor Flag" will be presented to every firm, the employees of which to the number of 75% subscribed to the loan an amount equal to 10% of the annual pay-roll. As in the past, we will be pleased to deduct the proper proportion from the pay envelope of each employee subscribing to loan. The schedule showing the amount of each payment will be handed to each subscriber at the time subscription is made.

It is our hope that the employees of the Russell Motor Car Co. will be first among the industrial establishments of Canada to fly an "Honor flag" from the flag pole of our building.

With this in view a central executive, representative of the company's various departments, has been formed, teams will be organized to canvass every employee, and it is hoped no bonds will be subscribed for outside of this organization.

Faithfully yours,
RUSELL MOTOR CAR CO.. LIMITED,
T. A. RUSSELL,
Vice-President and General Manager

KITCHENER FACTORIES ARE ALL READY TO MAKE THE LOAN GROW

KITCHENER, October 28.—This hive of industries is all alive on the eve of the Fourth Victory Loan campaign. The objective for Kitchener has been fixed at $1,700,000 but a determined effort will be made to reach the $2,000,000 mark before the campaign concludes. The objective for North Waterloo has been set at $6,000,000, which is considered to be a fair average for this community.

In a city with over a hundred industries, and the great majority of its inhabitants wage-earners an unusual opportunity presents itself to show their determination to help the cause of the Allies by buying Victory bonds, and thus placing at the disposal of the government their savings. In some of the factories of this city from 80 to 90 per cent. of the employees purchased bonds in the third Victory Loan campaign, and many of them are anxiously awaiting the opportunity to add to the number of bonds they are holding at the present time.

The Dominion Rubber System, the largest employers of labor in this city, will inaugurate a thorough canvas of all the employees immediately after the bells and whistles announce the opening of the campaign. There are four factories here and a friendly rivalry is already created between the different branches in order to become the possessors of honor banners for exceeding the objectives set for their respective industries. Superintendents Charles, Smiley and Kabel will supervise the campaign for the System, under the direction of the Central Industrial Committee.

The Williams, Greene & Rome Co., shirt manufacturers, will make a strong bid for an honor banner. The firm is making special arrangements to accomodate the employees in the financing of the purchase bonds, with the object of encouraging practically a 100 per cent. subscription.

The Kaufman Rubber Co., is another industry that promises to make a good showing. The organization of the staff is under the direction of Mr. Frank Dunham, and nothing will be left undone to secure subscriptions from every employee in this growing industry.

The furniture industries are being organized in groups and will be canvassed by specially selected enthusiasts. Similar arrangements are being completed by the Industrial Committee to canvas every factory, which will be done during the second week of the campaign, to be known as "Industrial Week." Previous to that time the workers will be circularized, and addresses will be delivered by prominent citizens, urging the importance of this hitherto German-speaking centre to show itself to be 100 per cent. British by buying Victory bonds until they feel it.

HOW CANADIAN VICKERS HELP THEIR MEN TO PURCHASE BONDS

MONTREAL, Oct. 28.—To obtain the enrollment of their employees on the list of subscribers to last year's Victory Loan the Canadian Vickers, Ltd., adopted a scheme to obtain the co-operation of their men that met with good response, by a very large number. Two plans were in operation and known as the Victory Loan Plan and the Canadian Vickers Plan. With the first we are all more or less familiar, but the operation of the latter method had features that generally appealed to the workers. The bonds were offered to the men on the payment of $1 per week for each $50 bond taken; that is, if the value of the bonds was $100, the purchaser was expected to pay $2 per week, a $200 bond would mean a payment of $4 per week. These payments were deducted from the weekly amount due to each workman—or member of the staff—for a period of 49 weeks, and the final or fiftieth week a further sum of 22 cents was collected for every $50 bond. This meant a relative saving to the bond holder of 78 cents, as he obtained possession of his bond after payment of $49.22. For a $100 bond the amount collected would be $98.44. This saving to the men was affected by the accumulation of the payments from the inauguration of the loan up to the first of May, when the permanent bonds were available; the Company, however, collecting the first six month's interest. The total number of men participating in the buying of bonds was upwards of 1,870, which was over 60 per cent. of the total number employed at the plant. The value of the bonds taken was invariably of $50 denomination, but in many cases $100 worth were taken by the men and $500 worth by the leading officials under the Canadian Vickers plan. The total amount realized under the company's plan was over $172,000, this amount being exclusive of any bonds purchased by the men from outside sources. This account is kept separate from the general funds of the company and is known as the Canadian Vickers Employees' Account. It has not been definitely decided what will be the policy this year, but Mr. H. Williams, the comptroller of the company, who is supervising the operation of the loan among the employees, anticipates that the same scheme will be operative this year with slight modifications to meet the conditions of the new bond issue.

STEEL WORKERS' PAY INCREASED

SYDNEY, N. S.—Official announcement was made at the steel works that all rates for employees whose earnings on 31st August last were less than forty-five cents per hour, would be advanced two and one-half cents per hour, that all other rates would be advanced two cents per hour, and that these changes were retroactive to last September. This means that all employees will receive with their pay for the last half of October a bonus equivalent to the amount of the extra pay for two months.

This is the third general revision of rates made during the current year in addition to many special or partial revisions, the combined effect of which is to raise the average daily wage of all employees over one dollar above the corresponding average for the year 1917—equal to about 33 1-3 per cent. between the years 1916 and 1917, and 5 per cent. between the years 1915 and 1916, and makes the average daily wage of all employees nearly double what it was in pre-war days. The minimum rate for unskilled labor has increased 114 per cent. since January, 1916.

LONDON MANUFACTURERS HAVE THEIR JOB WELL IN HAND NOW

LONDON. Oct. 28.—London manufacturers are bound to see that they are well represented among the purchasers of Victory bonds during the present campaign. With this end in view an industrial committee has been established with Arthur W. White, vice-president and manager of the George White & Sons, Company, Limited, as chairman. Associated with him are the following manufacturers: Charles H. White, manager of the London Rolling Mills Company; Frank. E. Leonard, of E. Leonard & Sons, Limited; Chester F. Stevens, assistant general manager of the Empire Manufacturing Company; Lieut. Col. W. M. Gartshore, vice-president of McClary Manufacturing Company, Limited; J. Fred Grant, president of the National Brass Company; W. H. Heard, manager of Spramotor Company; F. McCormick, of McCormick Manufacturings are chosen from among the men president of McClary Manufacturing Company, Limited, and T. W. McFarland, vice-president of D. S. Perrin & Company, Limited.

Mr. White as chairman has been working hard to get the various industries in line for the big drive. Small cards setting forth the need of the hour were enclosed in all the pay envelopes of London last week. Each employee in the several factories will be personally canvassed. This work has been undertaken in the above firms by the respective representatives on the industrial committee.

Meetings are being held in the workshops to arouse the interest of the employees. The speakers for these meetings are chosen from among the men who are best acquainted with the lines manufactured by the men whom they address.

A friendly spirit of rivalry has been developed between the various departments of each factory and also between the several factories. In this way the men are stimulated to their best work.

One million dollars has been set as the objective by the industrial committee. This is $400,000 more than the amount subscribed by industrial London to the Victory Loan of last year. With the efficient organization this year it is confidently expected that industrial London will go over the top.

GRAND TRUNK IN TORONTO ORGANIZE TO SELL WAR BONDS

The Grand Trunk men in Ontario are going "over the top" in valiant fashion in the big Victory Loan drive. The final details of the G. T. R. officers and employees' organization to support the loan of 1918 were decided upon during the past week-end, when superintendents of motive power, master car builders and other heads of departments were called together in Toronto from various centres in the province to discuss with General Superintendent Bowker and other officials the plans for ensuring a maximum subscription to the loan from the railway's men. C. R. Moore, assistant to operating vice-president; C. Manning, assistant to vice-president in charge of motive power and car departments, were present from Montreal to outline the general plan that has been adopted over the whole system.

They stated that from one end of the line to the other assurances were forthcoming of increased support for the loan. The Ontario lines of the Grand Trunk had always done splendidly in the patriotic campaigns, and the management of the road and all interested in the success of the effort to maintain the Dominion's war activities at their maximum were looking forward to the establishment this fall of a new Victory Loan record by the G. T. R. men in Ontario. Every man in the service is to be canvassed, and the company has made arrangements whereby the Victory Loan payments may be spread over a period of ten months.

BRANTFORD SETS TEN PER CENT. AS MARK IN THE VICTORY LOAN

BRANTFORD. Oct. 28.—Industrial Brantford is lined up solidly against the Hun. The organization for the Victory Loan, achieved almost at the last minute owing to the disruption which the influenza epidemic had brought about, is such that the manufacturers are confident that this city will go away over its objective, and that the factories' organization will have the largest share in bringing this to pass.

A rousing meeting of representatives of manufacturing plants and wholesalers was held in the local Victory Loan headquarters on Friday afternoon, with every class of industry represented. At this meeting steps were immediately taken for the formation of a thorough organization, to be based on specific conditions agreed to by the gathering. These were generally to have the example in subscribing set by the factories to the employees, and to leave no stone unturned to bring the latter to a realization of the great need for funds.

With the factory managements pledged to devote all of their funds that they possibly could to the loan, it was decided to appeal to the employees to put all the cash their pockets could spare into the loan, with a special effort being made to secure every factory an "honor flag." The factory managements will undertake to receive the men's subscriptions, and to turn the complete quota into the local headquarters as one big subscription. The firms will also undertake to carry the men's bonds, allowing small payments to be made as convenient to the men. Where, through sickness or other causes, bonds have to be forfeited by the employee purchasers, the firms will make every effort to dispose of the bonds without any loss to the employee. In every factory, shop committees will be formed by and from the men themselves, and to these committees every assistance will be given by the firm.

The appeal to be made will be an open one, but the objective of every shop has been decided on the basis of ten per cent. of the yearly pay roll for that shop. Thus, a firm with 250 men, with a pay roll of $300,000 would be expected to have its men in line for $30,000 in bonds, while one with 40 men and a pay roll of $40,000 would be expected to have its list up to $4,000. This is exclusive of the executive staff of the factory, or heads of departments referring only to the normal pay roll.

The committee chosen by the manufacturers to act for Brantford's industrial life as a whole, is composed of J. B. Detwiler, Steel Company of Canada; S. B. Chadsey, Massey-Harris; C. G. Ellis, Barber-Ellis, and W. J Verity, Verity Plow Company.

FEEDING A SOLDIER

It costs from 45 to 50 cents a day to feed a United States soldier. It takes about 478,515,000 pounds of beef a year for an army of 3,000,000 men.

The Morse Chain Company, Ithaca, N. Y., have recently sent us a copy of a booklet of data sheets containing useful information regarding silent chain drives. The booklet is illustrated with cuts of engines and drives and covers the subject of the number of teeth and links, lubricating and venting, sprocket materials, chain widths, chain contacts, chain adjustments, etc. It will be sent free.

Manufacturing Steel Bars for Rifle Barrels

Quality Required—Size of Billets—Furnaces—Care in Rolling and Heating Needed—Composition of Metal Most Desirable in Rolls

By W. S. STANDIFORD

THE great world conflict which is raging has resulted in a heavy demand upon our manufacturers for munitions and various implements of destruction; among the most important being rifles, of which large quantities are manufactured. As they are used extensively, the designs of the rolls, their proper adjustment and handling will be found interesting to the readers of this magazine. The steel is manufactured by the open-hearth process. It contains 0.40 per cent. of carbon and also 3.00 per cent. of nickel. This makes a very strong metal, capable of withstanding the high pressures exerted by smokeless powder which is used in modern rifles.

Billets

The steel for making the rounds is in the shape of 4 3-8 inch square billets, having rounded corners and cut to lengths to suit the engine power and furnace requirements of the mill using them; the average mill using a billet about two feet long. Where mills do not have a steel making plant the billets are usually purchased. As the heating furnace plays a most important part in the manufacture of steel bars, it will be considered first. There are various designs of furnaces used by manufacturers for heating steel, each one being built with a capacity suited to the roll equipment of the mill; the idea being in all cases to so proportion the work that the workmen on the day turn will have their steel rolled on schedule time and be out of the way when the night men report for duty.

As the output of finished material falls off in the summer time, which is due to the intense heat radiated from the furnace added to that of the weather, efforts have been made to devise means to keep the front of the furnace cooler, so that the heater will be able to keep the output up to the maximum tonnage. This is achieved by the use of a "water-curtain" shown in Fig. 1. It consists of a rectangular shaped sheet metal screen suspended by three door hangers placed on an iron track.

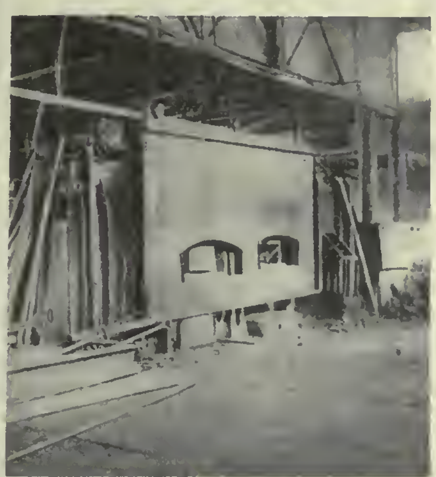


Fig. 1—Illustrates a good working heating furnace having the water-curtain in place. This is a very effective device and gives the workmen more comfort from the intense heat radiated from the furnace.

Water Curtain

The two charging doors seen in the illustration have angle iron around their edges so as to keep the water from flowing into the furnace. Riveted to bottom is a trough having a pipe on left side, which receives the water and conveys it to the bosh. At the top and extending lengthwise is the spray pipe; this has a row of small holes in the bottom which allows the water to flow against the side of the curtain. The spray-pipe is capped at one end and connected to the water supply at the other.

This curtain is not used in the winter time, it being easily removed by disconnecting the supply pipe and lifting the apparatus off the trolley track. In use, the water curtain proves very effective. Heating iron or steel calls for the utmost skill and care upon the heater's part, as the latter by his handling of the furnace can spoil the best metal ever made—too quick heating burns the outside, while the interior of the billet is not hot enough. If they are sent to the rolls in this condition the finished bars will be very brittle, splitting lengthwise in the middle when bent. If they are unevenly heated there being cold spots on the billet, the finished product will be wavy in appearance and varying in size due to the rolls springing more on the cold than on the hot parts. If the steel is left too long in the furnace it loses its quality by absorbing the gases given out by the coal —the result being that the metal is brittle and has little tensile strength compared with a billet that has been properly heated.

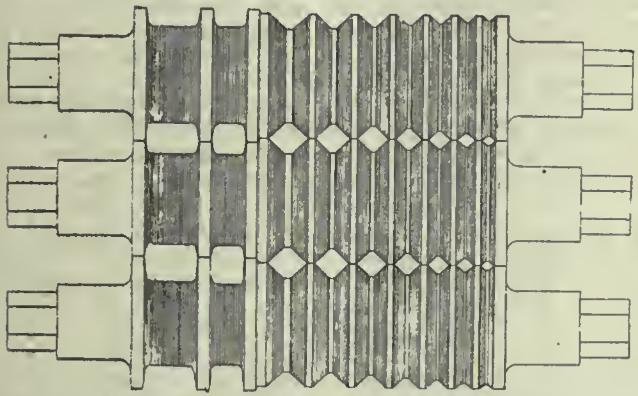


Fig. 2—Roughing rolls showing box and edging passes. Steel is entered into the deepest pass in bottom roll, goes from that into the top groove, it being then turned over on edge and inserted into the deepest edging pass, bar then is inserted into the top edging pass, which squares it up ready for the angle pass. These type of rolls are very efficient and give good service.

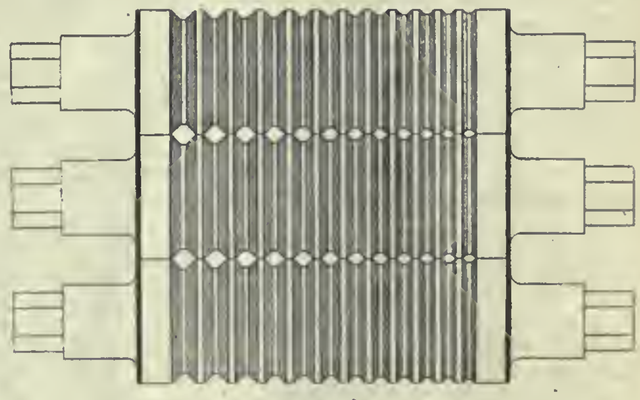


Fig. 4—Depicts the oval rolls. The violent change in section of the metal from a square to an oval aids in making the bar fibrous in nature.

Rolls

From the foregoing it will readily be seen that the heating of iron or steel must not be done too quickly, nor too slowly, if a fine quality of product is desired. It may be thought that as the billets are the same in size and weight, that it would be a very easy matter to heat them all evenly, but although the furnace is supplied with billets of a uniform size and weight, so as to make a lot of bars of the same length, it by no means follows that the heating of any one billet will take the same time as another. The heating of a furnace with

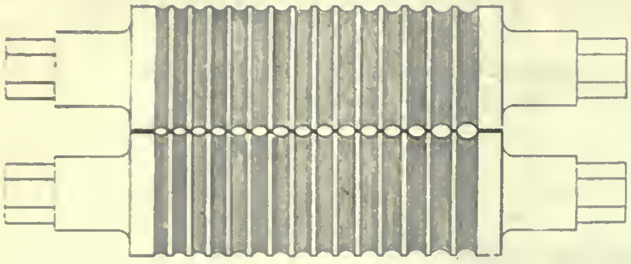


Fig. 3—Strand rolls showing the fillets in the bottoms of the grooves. The fillets make the edges of the bar fibrous in character, which is so essential for strength in iron and steel sections. Being made out o. chilled iron these rolls wear long.

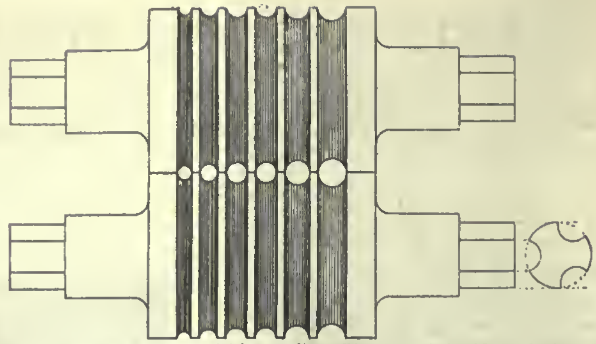


Fig. 5—Illustrates the finishing rolls. The rounded sides of the oval easily conforms to the shape of the round groove. In practice, these rolls are worked with 1-32 of an inch light between their collars, which prevents their delicate edges from breaking. The change in the shape of bar from oval to round also adds to the fibrous nature of the metal.

coal precludes the possibility of securing the even heating of all of the billets at the same time. As a general rule there will be a sufficient number of them hot enough to start the rolling and by the time these are sent to the rolls the others are ready. The train of rolls used to make these 1 1-8 inch steel bars consists of roughers, strands, ovals and guide rounds or finishers. The roughing rolls are three-high and are made out of either cast iron or steel, the latter metal being the best, as it stands rough usage better, it occasionally happening that a pair of tongs will slip out of the rougher's hands and go into the rolls. If they are made out of cast iron a collar will be broken off, thus the set will be idle until a new roll can be turned. If a pair of tongs goes into steel rolls it will be cut in two —the collar edge where it cut the tongs will be dented, which does not prevent the rolls from working. And as it takes a blacksmith about three hours to make a new pair of tongs, while it will consume about one week's time to turn a new roll, it will be seen that the steel roughing rolls are more economical than cast iron ones.

In purchasing steel rolls it is best to get a metal having a high carbon content, as they wear better in the mill and do not bend, besides giving good satisfaction to the users. Following is a chemical analysis of roll steel which is considered "next to the ideal metal by chemists," rolls of this analysis having stood the roughest kind of usage in the mill and lasting long in the housings before requiring dressing in the lathe.

Carbon; combined, .49; silicon, .211; sulphur, .036; phosphorus, .041; manganese, .68.

The type of roughing rolls used in modern mills is the box and edging pass design, illustrated in Fig. 2. Box and edging passes reduce the billet much quicker than the gothic-shaped grooves which were much formerly used. The roughing rolls used to make the round steel bars for rifle barrels are each 10 inches in diameter and 40 inches long, excluding necks and wobbler lengths. They contain a box and edging pass in each roll in addition to the angle grooves, of which there are nine in each roll ranging in size from 2 1-4 inches downwards. For the sake of clearness in the photographs, the full number of angle passes are not shown. The white-hot billet from the furnace goes through the various passes in the roughing rolls until it is reduced to 1½ inches in diameter.

It is then ready for the strand rolls depicted in Fig. 3. Like the roughers, these are three high, each roll being ten inches in diameter. In body length they are 30 inches long, being ten inches shorter than the roughing rolls. Strand rolls are made of chilled iron, so as to give long service in the mill before requiring dressing—as a general rule they will last in the average mill between three and four months before the grooves wear out of shape. They contain the following passes, each one having an angle of 92 degrees. 1 7-16, 1 3-8, 1 5-16, 1 1-4, 1 3-16, 1 1-8, 1 1-8, 1 1-16, 1 1-16, 1 15-16, 7-8, 13-16, and 3-4 inches. It will be observed that there are a number of duplicate passes. These are put in the rolls, so that when one groove wears out another of the same size can be used by the roller; thus allowing the rolls to be in use longer.

As the grooves vary in size by sixteenths, the roller can, by raising the rolls, make a 1 1-2 inch bar in the 1 7-16 inch pass—this method of using the grooves in the strand rolls also allows them to be in use longer before they require dressing in the lathe, money being saved for the firm by this method of handling. The 1 1-2 inch bar from the roughers is taken over to the strand rolls and goes once through the 1 3-8 inch pass and from thence into the 1 1-4 inch strand groove. After going once through this pass the bar is turned over at a right angle and pushed through the same sized pass again, the idea being to have all four corners of the bar with square fillets, all being as perfect as possible, which the double rolling in the one-sized pass secures.

Grooves

By inspection of the strand roll picture it will be seen that the corners of the grooves are not left with a sharp edge, but that they have a small fillet at the bottom. This is done so that the corners (the weakest part of the bar) will be worked as much as possible, so that they will have a uniform strength compared to the rest of the bar, and also keep the grooves in the oval from wearing out rapidly, which would be the case if sharp edged strand bars were used. The bar is now ready for the oval rolls shown in Fig. 4. These are two-high and have the same lengths and diameters as the strands. They are also made of cilled cast iron and wear well. This set contains the following passes, some being duplicate.

One 3-4, one 13-16, two 7-8, two 15-16, three 1 inch, two 1 1-16, two 1 1-8, one 1 3-16, and one 1 1-4 inch pass. The above sizes must not be taken as the actual widths of the grooves, but they are used to designate the size of oval used to make a certain size of round; thus the 1 1-8 inch oval takes its name from the size of round made in the finishing rolls. The strand bar is placed on its side and inserted into the oval groove. This changes the shape of the 1 1-4 inch square bar to an oval one 1 7-16 inches wide by 1 inch thick. There are different styles of oval grooves put in rolls to make round bars—some being very wide and not very thick; others approach the size of the round bar to be made, the thickness being nearly the same diameter as the round, the width being only 3-16 of an inch larger. Such an oval will not cause the finishing grooves to lose their shape as quickly as the sharper and thinner ovals do; therefore, they last longer in the mill before requiring dressing. There is one drawback to the rounder shape of ovals, viz.: They are harder to insert into the round groove, especially when the speed of the engine is high, or when the end of the bar is colder than other parts. The sharper edged ovals enter the round groove very quickly, whether the speed of the engine is high or low. The width of oval used to make the 1 1-8 inch steel bar occupies an intermediate position, it being between the round and sharp edged ones. We now come to the design of the finishing rolls shown in Fig. 5. As this is a 10-inch train of rolls, the guide rounds are also ten inches in diameter, the top roll being one-eighth of an inch larger in diameter, so that the faster peripheral speed of this roll will deliver the finished metal in a straight line.

Like the strands and ovals, these rolls

(Continued on page 515)

Causes of Defects in Steel Ingots

Influence of Casting in Relation to Bar — Bottom Cast Steel — Top Poured Steel — Composition of Slag

By J. N. KILBY

At the September meeting of 1916 and the May meeting of 1917, of the Iron and Steel Institute, papers were presented by the author dealing with defects found in steel ingots or in the article manufactured. Papers upon the same subject have also been read before the Sheffield Society of Engineers and Metallurgists and the Staffordshire Iron and Steel Institute. In this present paper, read before the Iron and Steel Institute and reported in *Engineering*, it is intended to extract some of the matter given in the last two papers, coupled with further observations and results.

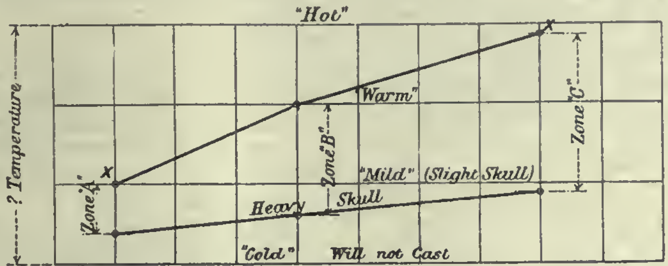


FIG. 1—Zone "A" nozzle 1½ in. Where the ladle running at full stream above capacity of the ingots upon the bed, and the rate of filling depends upon the teemer using the stopper throughout. Zone "B"—Nozzle 1⅛ in. Where the number of ingots per bed is just under the capacity of the ladle, casting at full stream. Zone "C"—Nozzle ⅞ in. Where the nozzle size and the capacity of the ingots on the bed balance when casting full stream, the steel tending to freeze slightly on the surface during filling.

Previous Conclusions Upon Influence of Casting in Relation to Cracks in The Ingot of Bar

It is generally accepted that the important factors are:—

1. Temperature of the steel at casting.
2. Speed with which the mould is filled.

Other yet lesser factors are:—

1. Whether the ingot is bottom or top-poured.
2. Size and weight of the ingot.
3. Cross-sectional area compared with length.
4. Composition of the steel.
5. Weight of steel to be cast from the ladle.

Temperature of the Steel

Different opinions still exist as to the present value of pyrometry in controlling the furnace product. In November last this variance of opinion was obvious at a gathering of experts upon the subject. (Faraday Society. See *Engineering*, November 9, 16 and 23, 1917.) I give here some views upon the matter, which at the least do not agree.

		MINUTES				AVERAGE
A	TIME EACH INGOT	1½	2	2½	3	10%
	DEFECTS AT MILL	20%	10%	5%	3%	
B	TIME EACH INGOT	2	2½	3	3½	5%
	DEFECTS AT MILL	10%	5%	3%	2%	
C	TIME EACH INGOT	3	3½	4	4½	1%
	DEFECTS AT MILL	2	1	RARELY CRACK		

FIG. 2—Showing yield of sound steel free from cracks in rolling to be read with Fig. 1.

Dr. Rogers, in his criticism of my last paper in May, says "that a good deal could be done with the aid of pyrometers, but that he had not found them to be sufficient in themselves, and that his own efforts in the direction of inventing a pyrometer to overcome the limitations were not as yet completely successful."

He further states that "he quite well knew the temperature of the bath, vision also being supplemented in many practical ways; so that control and investigation of the process presented no difficulty in that respect." No doubt a good deal can be done when the temperature of the steel in the furnace can be determined accurately: it is not much that divides, but, unfortunately, it is the mainspring of the whole. High temperature just prior to tapping can be easily be adjusted by additions of scrap.

Mr. Service thought I relied too much upon what he termed "experience and eye method." The opinion of Mr. Service is very interesting when compared with the following extract from Mr. Cosmo Johns' paper, published in *The Iron and Coal Trades Review* for November 16, 1917:—

"It was found that a skilled observer could, with the aid of blue glasses, from observations of the steel as it poured from the furnace into the ladle, estimate differences of possibly 10deg., and certainly 15 deg., apparent temperature; while men, watching the pouring of the steel from the ladle into the moulds, where the increased viscosity, due to decreased temperature and other factors, rendered possible a greater precision in the estimate, could certainly distinguish differences of 10 deg. apparent temperature. Any pyrometer adopted must therefore be capable of giving consistent readings with greater precision than 10 deg. As a matter of fact, a trained observer can, with a suitable instrument, obtain readings with a variation of 2-5 de. under very favorable conditions, and this degree of accuracy is more than sufficient for effective control of the metallurgical processes employed. For each class of steel it is only necessary to determine—for the particular casting method employed—the 'normal' temperature when the steel is tapped from the furnace, which gives the best result. This 'normal' may vary as the process employed is modified. The measurements involved are therefore divergences from the particular 'normal' adopted at the time, and as the range of variation in regular practice is small, no appreciable error is introduced by considering the differences in the pyrometer reading as temperature differences. The desirable temperature varies 10 deg. apparent from the normal, and a very high percentage of the casts does not appreciably exceed these limits. Temperature variations of 20 deg. apparent give rise to serious difficulties, and 15 deg. apparent can be considered to be the variation admitted in practice. These limits are for special steels; they are wider for ordinary commercial steels."

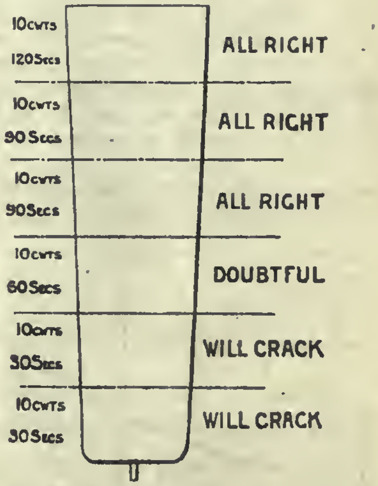


FIG. 3—3-ton ingot to be cut up for tire blocks. Total teeming time, 7 minutes. Top half, passable, bottom half sure to crack. (Where nozzle full stream exceeds capacity of ingot). As shown the time varies for each 10 cwt. portion and would result in defects according to the time taken for each portion.

A statement by Dr. W. Hatfield on "pyrometers from the Standpoint of Ferrous Metallurgy," published in *The Iron and Coal Trades Review* for November 9 of last year, may be of interest at this point:—

"Although the temperature at which steels are cast must have an influence upon their ultimate physical properties, no ready or really reliable method for measuring such temperatures from the works standpoint is available. This is a considered statement. It would obviously be of considerable use if the temperatures of successive heats could be controlled and determined."

When one speaks of casting temperatures, the terms hot or mild are purely relative to the product desired, though they are often used without full regard to accuracy. For instance, a cast alleged to be on the "hot" side may produce ingots free from cracks, provided the period of filling be prolonged to the correct extent by using correct-sized nozzles, or secondary ladles, or, when bottoming casting, putting down a sufficiently large number of ingot moulds per bed. Further, a cast alleged to be on the cool side will most certainly yield ingots which will crack at cogging, if they have been teemed relatively quickly. Teeming speed is really of greater importance than temperature, taking the variation from one cast to another to be within usual everyday practice, and omitting exceptional cases of hot steel caused by careless manipulation.

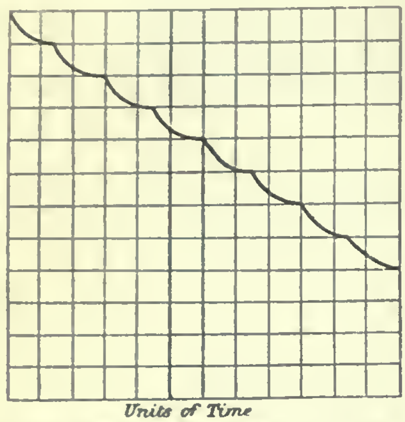


FIG. 4A—Where insufficient Ca O or no Ca O is used. Showing erratic fall in carbon and consequent variable condition at finishing.

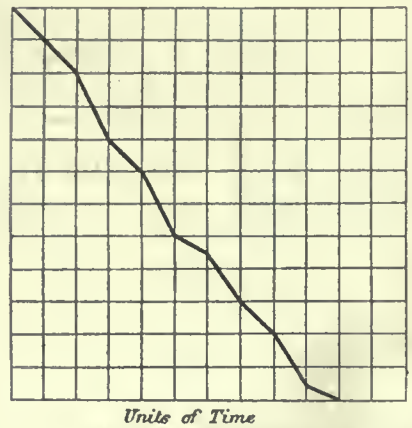


FIG. 4B—Where the slag contains the correct Ca O per cent. Showing correct bath conditions at any period of the boil.

Of all trades and processes the steel trade stands first in it dependency upon the personal equation and the whole business appears to be one compromise after another. The only direction in which we can work is to avoid all unnecessary complications, and to provide methods possessing the widest margin of safety.

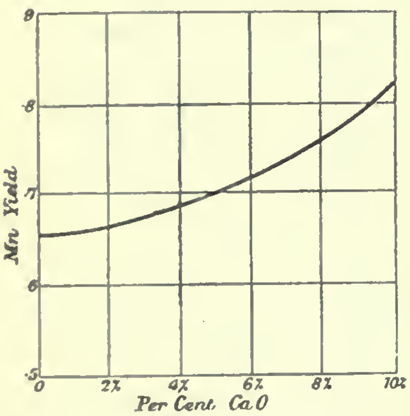


FIG. 5—To show relationship between Mn. yield into the steel and the percentage of Ca O in the slag all varying factors, of course, being considered.

Argument upon casting temperatures would lead one to suppose that the difference in degrees of heat was extremely great. Experience proves that this difference, coupled with the factor of safety is not great. The casting of heat after heat with a slight skull left behind, at the same time getting cracked ingots in the mill or forge, points to the great importance of correct teeming speed per ingot. Speaking of casting temperatures and skulls, a case occurs to my mind of the principal of a firm who insisted upon the necessity of cool steel, asking for confirmatory evidence in the form of a certain minimum weight of skull (5 cwt.) each time. After numerous too successful attempts at the weight desired (very often resulting in the loss of the entire cast) someone discovered that, by ramming or bricking the ladle bottom in a direction sloping away from the nozzle, a skull of consistent weight could be obtained every time, even on the warmest of casts, but all casts were thereafter accepted as cool.

Bottom Cast Steel

The objects achieved by bottom casting are:

1. Better surface of ingot.
2. Less splash.
3. Freedom from cracks during working.

The first two items are generally obtained, but the third is dependent upon factors already detailed. There are a great many objections to the bottom casting of steel, the danger of the extraneous inclusions being far greater than is the case in top casting.

It is possible to cast group of ingots from the same heat and have a number of them work well while others will be very badly cracked.

It will be seen that casting through varying sized nozzles, or varying weight per bed, one may easily obtain great differences in the actual time required to fill each ingot. The time factor governs the first formation of solid steel, and decides whether the later contraction will crack the ingot or not. The steel should not fill the mould in too free a manner, but should tend to scum over and gradually and evenly form a thin cover of semi-solid steel from the bottom to the top as the filling proceeds.

If one casts a charge steel in the following manner:

1st bed ....6 ingots.
2nd bed ....5 ingots.
3rd bed ....4 ingots.
4th bed ....3 ingots.
5th bed ....2 ingots.

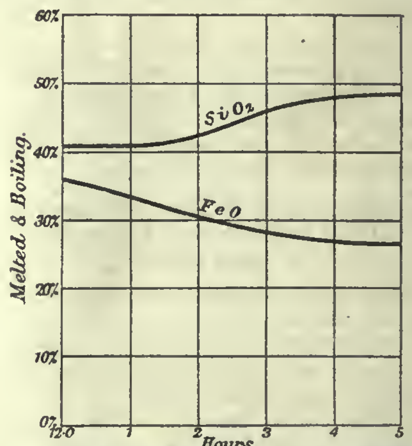
with a similar stream from the ladle in each case, the result would give a variation in percentages of defects to the proportion of increase of the speed with which the moulds filled (see Figs. 1 and 2). Cheese tires amply prove this, e.g., I found that in casting 480-lb. cheese tyres the percentages of defects were as follows:

Minutes.

¾......All cracked under pressure.
1 ......50% cracked under press.
1¼......25% cracked under press.
1½...... 5% cracked under press.
1¾...... 2% cracked under press.
2 and over..None.

Again, with regard to tyre steel, where ingots are sliced into blocks and afterwards, etc., varying results may be obtained upon the self-same ingot, due to erratic teeming, as indicated by Fig. 3.

Regarding the base of bottom portion of any bottom-poured ingot (where a good percentage of defects will show, if visible anywhere), it is important not to rush the first foot of the ingot during teeming.



TIME	FEEDS			CARBON	SILICON	TIME	FEEDS			CARBON	SILICON
	ORE	LIMESTONE	PIG IRON	BATH SAMPLES			ORE	LIME	PIG	BATH SAMPLES	
12·0	–	–	–	1·00	·010	2·30	–	5 CWT.	5 CWT.	·26	·030
12·30	–	–	–	·90	·010	3·0	–	–	–	·21	·030
1·0	–	–	5 CWT.	·70	·018	3·30	–	–	–	·17	·027
1·30	–	–	5 CWT.	·55	·026	4·0	–	–	–	·17	·030
2·0	–	½ CWT.	5 CWT.	·37	·026	4·30	–	–	–	·17	–

(5470 F.)

FIG. 6—Finishing added in bath; Fe Mn in bath 5 minutes. Theoretically: Carbon, 0.15; silicon, 0.15;; manganese, 1.10. Practically: Carbon, 0.06; silicon, 01.10; manganese, 0.63.
To show bad case of over-oxidised charge during melting. Also conditions subsequently and analysis of steel, etc.

Variation in the teeming speed either in the individual groups of ingots, in a cast, or from one cast to another, is therefore to be brought to a minimum. There is a definite time per ton for any mould; above this time no cracks result, but below it trouble begins, in spite of "cool" steel.

From the foregoing remarks relative to bottom-cast steel, the logical conclusions to be deduced are: That the pitman must be in such a position that he cannot possibly teem too quickly, and that the speed must be such as to be safe,

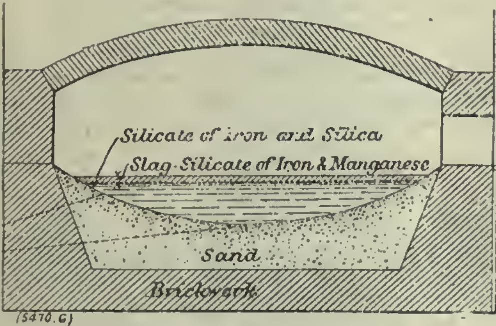


FIG. 7—Section of acid lined furnace.

yet so regulated that the cast can be successfully dealt with. Where slow teeming depends entirely upon stopper manipulation erratic results are certain.

Top-Poured Steel

Certain classes of steel are cast to advantage by being top poured.

Such material is always freer from extraneous inclusions and shows fewer defects from this cause when the ultimate article has to be machined and closely scrutinized. The compensating disadvantage, however, of top pouring steel is the greater liability of obtaining cracked ingots. In many cases no regard is paid to the actual time in filing the moulds or finding the speed most conducive to correct results.

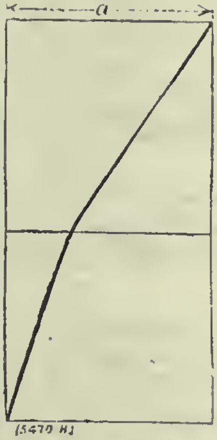
Speed in filling the mould is the most important factor at any time in the process of steel-making. Provided that the speed of a top-poured ingot compares equally with a bottom-poured one, similar in size, corresponding results can be obtained as far as freedom from cracks or rokes is concerned. When top pouring, the flow of the steel tends to force any particles of extraneous matter to the sides of the ingot, thus making a purely surface defect, as compared with an embedded one in the case of bottoming pouring. When taking teeming times the period should commence from the moment the steel enters the mould to the instant that "feeding," as it is termed, takes place. Two ingots may be teemed, the total time being equally divided between them, yet one may be sound and the other work badly; the reason for this being that the time taken by the latter may have been spent, not in casting the ingot proper, but in feeding the last portion. The smaller the ingot the greater the comparative necessity of top pouring correctly.

It is somewhat striking to note the differences one finds in teeming speeds, for a given weight, at different works. For the same quality of steel in a 65-cwt. ingot, teeming times varying from 1 minute up to 10 minutes for the whole ingot have been noted.

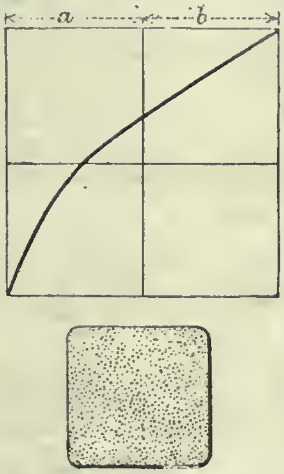
Dr. Burgess, in his communication on Brearley's paper,* gives his time for teeming a 7,200-lb. ingot as 1 minute. Taking a similar ingot my experience is that, when teemed under 3 minutes, 80 per cent. will show cracks at rolling, the safety line actually being 6 minutes.

should the steel be so cool as to lap badly, the chances are much against the mould filling at all.

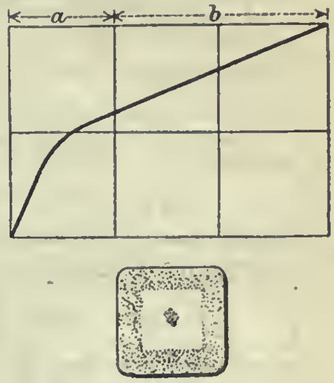
Chrome, high silicon and vanadium steel are always subject to lappiness in a greater or less degree. The appearance of the ingot will give some idea whether this lappiness is going to be a serious defect or not. If the teeming is so slow as to allow the steel to form a solid cake or cover, through which it afterwards bursts (and this frequently occurs in this class of steel), the result will be sufficiently serious to attract notice later when machining. The formation of oxide films on the surface of such slowly cast ingots tends to give fine elongated seams or pockets when the steel is rolled. The use of pitch, ground as fine as flour, in the mould as the steel arises, must necessarily help to minimize the danger, as also the tarring of the mould. An ingot scumming over too quickly will clean itself with a minute proportion of



Cheese tire ingot where the entire ingot is solidified by direct cooling of the mould itself. Inclusions finely disseminated.



10" square ingot. Where a large portion of the ingot is chilled. Inclusions fairly well distributed.



14" square ingot, where about one-third of the ingot is chilled. The dotted area in small bars from the ingots show where inclusions would be located.

FIGS. 8, 9 AND 10—"A" shows proportion of ingot solidified by chilling effect of the mould; "B" shows proportion solidified by radiation. The curves show the rate of solidification of the whole ingot. The slag particles are fairly evenly distributed in the chilled area but are found more locally in the more slowly solidified steel.

Lappiness

Bottom-poured steel cast at too low a temperature or too slow a speed tends to cause lappiness or folds, in the ingot. Ordinary carbon steels do not suffer much from this condition for the reason that, such pitch.† It is evident, therefore, that in the case of some steels there is a minimum rate below which the teeming must not drop.

The use of comparatively large nozzles in the ladle and a small weight per bed lead to what I term spasmodic teeming, the stream from the ladle running at full force being of greater volume than is compatible with the correct filling of the moulds. In these cases the teemer has to use his discretion and endeavor to control the stream so as to fill the moulds correctly. Often the result is an ingot teemed in widely varying speeds and lapped in a good many places, the stream being often momentarily cut off.

Composition of Slags of the Different Steel-Making Processes, Their Physical State, and Relationship to the Ultimate Product

Acid Open Hearth.—In the May paper of 1917 a number of charts were given with certain facts illustrating the effect of lime upon slag composition and the

No. 1—Section of basic open hearth steel showing unsoundness due to suitable conditions of slag and bath at tapping.

No. 2—Section of electric steel ingot showing (1) blowholes (wild steel); (2) lappiness, or folds in the ingot; (3) included unfluxed fire clay.

resultant physical conditions of the acid open-hearth process. It was my argument, based upon analyses and records, obtained from different works, and extending over a period of more than ten years, that the use of limestone or similarly constituted basic material was highly essential to the success of the process. That, with a slag containing certain percentages of lime, the danger of slag inclusion resulting from retained oxides, silicates, etc., was to a large extent minimized, at any rate, as far as furnace control could go. Further, that this was brought about by the lime slag

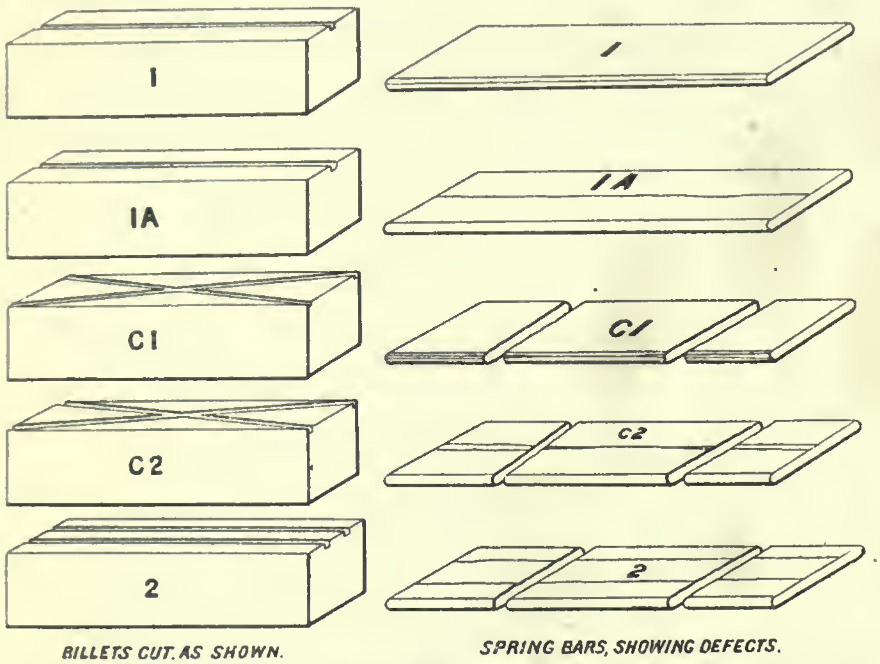


FIG. 11—To show 4 in. by 3 in. billets cut where marked to a depth of ¼ in. and afterwards rolled to show how defect developes. To illustrate effect of rocky billets

being in a perfect state of flux, thus yielding more intimate contact with the steel, and a state of receptivity for such undesirable inclusions referred to. Reference was also made to the control of carbon elimination.

Fig. 4 shows two diagrams, A and B:

(A) Charge worked throughout without CaO.

(B) Charge worked throughout with CaO.

In the top diagram (the charge without CaO) it will be noted that the fall in carbon is erratic and for a given time varies greatly. The bath at any stage would not be in a reliable condition, and naturally such heats usually vary in the finish results as far as analysis goes, apart from the other and greater evil of doubtful steel. In the bottom diagram where CaO has been introduced from the beginning and maintained throughout the process, the carbon elimination is more regular, and a charge could be tapped almost at any period without fear of very wrong results analytically. Consistent results from finishing material added are more readily obtained. Where large losses of manganese take place at the finishing stages, one may suspect bad cases of the trouble in question, viz., slag inclusions. The influence of CaO upon the manganese yield is very marked. Including all variables, particularly the time factor, and basing the figures given upon data extending over a huge number of casts, the relationship may be described thus:

The yield of manganese obtained in the steel in the bath, from added ferro-alloys, all variables considered, is proportionate to the CaO per cent. (or its equivalent of similar basic material) in the slag. See Fig. 4A or Fig. 5

It will be noted in Fig. 5 that the manganese yield obtained increases with the CaO per cent. in the slag. The curve is derived from the results of average casts, with varying CaO per cent. The difference as shown is immediate decrease of FeO in the slag immediate decrease of FeO in the slag, produce a more absorbent medium for any extraneous matter present in the steel.

4. That CaO is not added to thin the slag.

The elimination of any element or compound impurity from the metal into the slag or flux of almost any metallurgical refining process depends upon:—

(A) Temperature.

(B) The receptivity of such slag or flux for such impurity.

Furthermore, the last traces of impurity are usually most difficult of removal Consider for a moment, that in the case of particles of included matter in the steel, the loss of defective material through this cause is, comparatively speaking, only a very small proportion by weight. In the case of the acid open-hearth also let us consider that we are trying to remove traces of compounds somewhat similarly constituted chemically, to the envelope by which the molten metal is surrounded. Reference is made here to the sectional diagram of the acid open-hearth bath (Fig. 7.) When new, the hearth proper is composed, or should be composed, of semi-fused SiO_2 plus small percentages of oxides of alumina and iron. This assumes before charging the appearance of an almost white semi-glassy mass. In this condition it is in a highly absorbent state, and continues to take from the charge a large amount of oxides (not metallic matter) until the bottom becomes satisfied or completely impregnated. By this means the hearth becomes a most important source of influence upon the working of the steel and its ultimate composition, and possesses some relationship to certain classes of defects. There is a stage, usually after the first few heats, when the hearth, satisfied with oxides, reverses to some degree the action, relieving minute particles of non-metallic matter which are taken into the steel. The elimination of any such matter can only be effected through the absorbing properties of the slag, at least in so far as furnace operations are concerned. The composition of the slag, and its physical state, must therefore be so constituted as to aim at this desired and necessary form.

Thus far I have dealt with oxides formed during melting or introduced during boiling, and their possible elimination, by means of the slag influence upon them. Under good conditions, however, an appreciable residual amount not removable in the furnace remains in the steel. Commercially we may have steels termed free from the evil, which in point of fact are not. The amount present in such instances is insufficient to affect tests, or the speed of solidification and size of the ingots and the requirements of the manufactured article do not reveal, but tend to hide its presence. Small ingots retain the inclusion disseminated fairly evenly throughout the mass, the chilling effect of the mould preventing liquation of the particles. In the case of large ingots the reverse is experienced. A cheese tire ingot, for example, is subject to what I may term direct chilling solidification, or in other words, the mould influence outweighs the heat

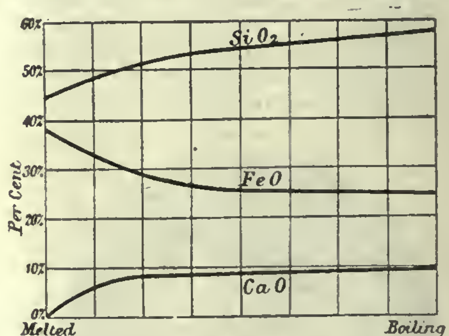
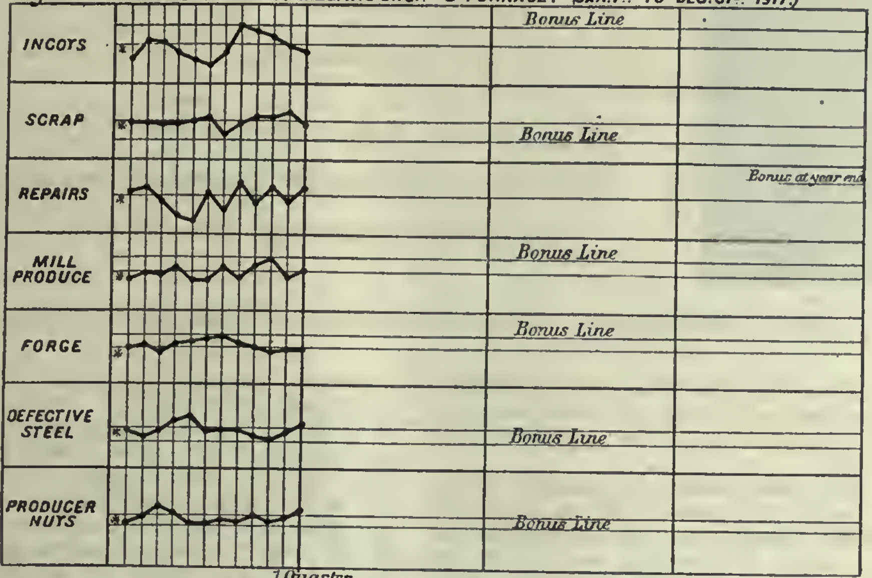


FIG. 12—Showing how addition of Ca O during period of melting to boiling influences slag composition.

above freezing-point possessed by the steel in the mould. Taking such an ingot, weighing only a few hundred-weights, and comparing it with one weighing about 25 tons, the actual time of solidification in the former case is in minutes, and in the latter many hours. We find therefore that weight and cross-sectional arena of the ingots have their own particular influences upon the locality of the inclusions. See Figs. 8, 9 and 10.

The article to be manufactured and the processes through which it passes

Fig. 13. YIELD & COST CHART. MELTING SHOP D FURNACE. (JAN. 1ST TO DEC. 31ST 1917.)



(5470 L) *Average for previous year or what is expected as minimum

To bring a closer relationship between melting shop, mill and forge, and to bring home defective material. Also to formulate a bonus system to increase output and quality, giving the steel-makers an interest beyond the ingot.

are important points bearing upon the subject. With small forgings or stampings in special steels, or highest grade wire, every few pounds of the whole cast is put practically to close physical and other tests, whilst close machining also tends to reveal defects of minute proportions yet sufficient to cause rejection and failure. The inevitable residual slag inclusions found in the ingot and not removable in the furnace present a difficulty worthy of overcoming. To cast the steel in such a manner as to bring the whole in direct contact with some absorbent flux either in the ladle or a secondary ladle, or in the mould, would possibly prove a successful course. Some essential basic fluxes have great affinity for oxides and silicates of iron, manganese, and aluminium, and the contact of the steel with such during the process of casting would certainly be at the least partially successful. It will be often noted, when casting steel by the tundish method, that a good deal of extraneous matter rises to the surface of the steel, due to giving up of matter previously held in suspension. The experiments made in the direction named do not warrant more on the subject at present, but certainly give incentive to more investigation.

Basic Open-Hearth Steel, With Some Reference to the Electric Process

During the last three years particularly the growth of the electric process of steel making has been nothing less than phenomenal. No one can dispute that the electric process can produce material easily, which in our acid or basic open-hearth would present considerable difficulty.

Of the many claims of the process, freedom from slag or gases has been most prominent. Correct manipulation will most probably justify this claim, but material is sometimes made which, as regards defect, rivals that by any other process. This defective material has been obtained naturally by wrong manipulation and the non-fulfilment of the priciples of sound steel-making, and the fault is not attributable therefore to the process.

The defects from which our basic open-hearth steel suffers are due to similar causes in the case of the electric process. That high-grade material can be made and is made on the basic hearth is undoubtedly correct. Numbers of otherwise practical men couple thoughts of basic steel with the inseparable phosphate slag, which has perhaps been the main obstruction to producing sound high-grade steel. A good many of the claims of the electric basic furnace apply equally as well to basic open-hearth. The main difference in the two processes, ignoring certain mechanical advantages, is the quick supply of local intense heat in the electric furnace. The physical state and chemical composition of the slag in a basic open-hearth process are the main essentials for success. Giving full appreciation to the valuable work done in this country by Mr. E. H. Saniter and other eminent metallurgists, in working out the process as a formidable competitor of the acid open-hearth, little has been done in establishing its position in the industry as far as special and alloy steels are concerned. The failure of the material is not due to the process, but to incomplete exploitation or faulty manipulation.

If the basic open-hearth process is worked with highly phosphoric raw material direct, and with one slag only, it will not prove to be a serious rival of the other processes in the special steel trades. I may be told that the particular advantage is in its adaptability to the use of almost any class of raw material. I maintain that the load (if I may use the term) of the working of the charge is in ratio to the phosphorus content; and that the means necessary for its removal constitute the first source of danger in the way of poor material. Charges relatively high in phosphorus have to be more than liberally dosed with oxide to effect elimination of that element, leaving behind in the steel the undesirable oxides producing the defect as shown in photograph No. 1.

*Journal of the Iron and Steel Institute, 1916, No. II., page 180.

†The use of anthracite for this purpose is fraught with great danger and should never be resorted to.

INTERESTING EXPERIMENTS

Proof of Earth's Revolution Can Be Obtained With Bowl

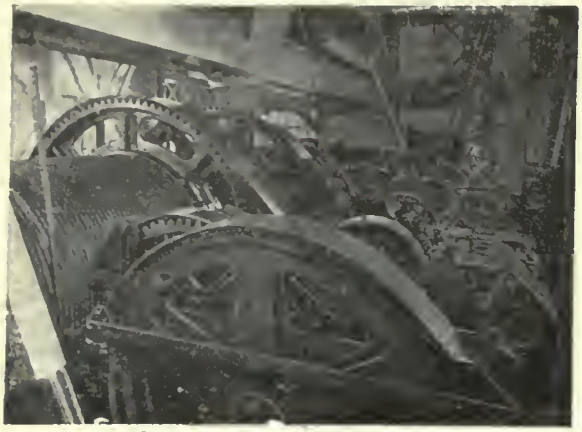
Take a good-sized bowl, fill it nearly full of water, and place it upon the floor of a room which is not exposed to shaking or jarring from the street. Sprinkle over the surface of the water a coating of lycopodium powder, which can be obtained at almost any chemist. Then upon the surface of this coating of powder make, with powdered charcoal a straight black line, say an inch or two in length.

Having made this little mark with the charcoal powder on the surface of the contents of the bowl, lay down upon the floor close to the bowl a stick or some other straight object, so that it will be exactly parallel with the mark. If the line happens to be parallel with a crack in the floor, or with any stationary object in the room, this will serve as well.

Leave the bowl undisturbed for a few hours, and then observe the position of the black mark with reference to the object with which it was parallel. It will be found to have moved in the direction opposite to that of the movement of the earth on its axis. The earth is simply revolving, has carried the water and everything else in the bowl round with it, but the powder on the surface has been left behind a little.

The line will always be found to have moved from east to west, which is perfectly good proof that everything else has moved the other way.

The Union Engine and Machine Works, Ltd., Montreal, has been incorporated with a capital stock of $300,000 by Walter R L. Shanks, Francis G. Bush, George R. Drennan and others, to manufacture machinery, tools, engines, etc.


60 H.P. motors and hoist drums.

LARGE AMERICAN NAVY CRANE AT PANAMA

Regenerative Breaking and Safety Devices Make Electrically-Operated Crane Safe From Operating Standpoint

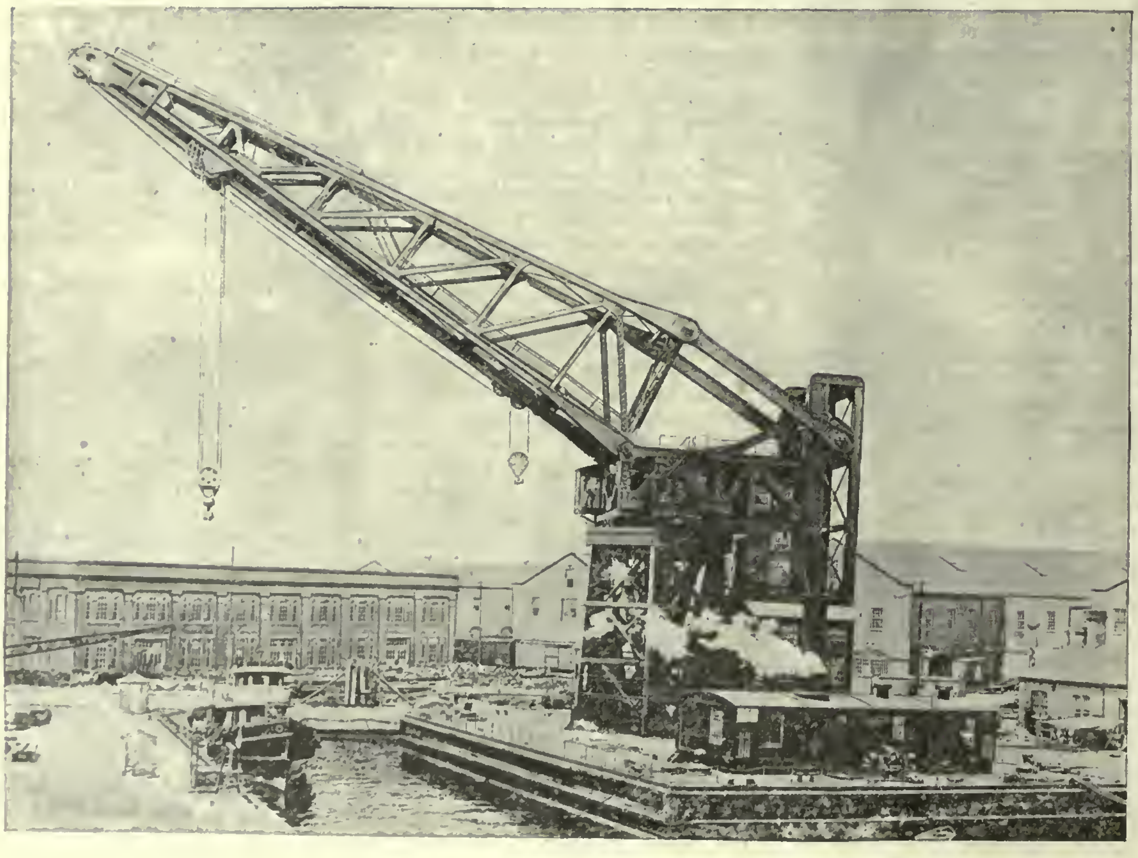
FLOATING cranes generally are of the bridge type and when operating the whole crane including the pontoon is manœuvered to bring the hoisting cables to the proper position for lifting. The one illustrated is of a revolving type and it operates on the principle similar to that of the ordinary derrick.

To give a concrete idea of the amount of work this apparatus can accomplish it may be said that its capacity is equivalent to the weight of 100 of the largest touring cars. The lifting hooks weigh about two tons, or the equivalent of a large touring car. When the jib is raised to its maximum height it is over 200 feet above the water level, a height greater than that of an 18 story building. As previously stated the whole structure is mounted on a flatboat, or floating pontoon.

The boat contains a complete boiler plant, and an engine driven generation which supplies the electric current for operating the various motions of the crane, which are controlled from a small house mounted high above the deck. By the means of a few levers and master controllers one operator is able to control all the functions with the utmost delicacy.

The speed can always be controlled by the means of the electrical mechanism of the crane. When heavy loads are lowered the motors are turned into generators and thus the speed is controlled with great accuracy. In the case of an accidental interruption of electric current, all of the crane's motions are automatically locked by means of brakes, and so ensure the impossibility of dropping the load. Safety and accuracy are essential, as the crane is used to handle large guns and turrets on battleships, and if through carelessness or inaccuracy these should be damaged, it would mean a loss of hundreds of thousands of dollars.

The illustration (Figure 2) shows the first work which the crane did. The navy tug "Massasoit" was suddenly sunk in one of the harbors. After divers had passed the necessary cables under the

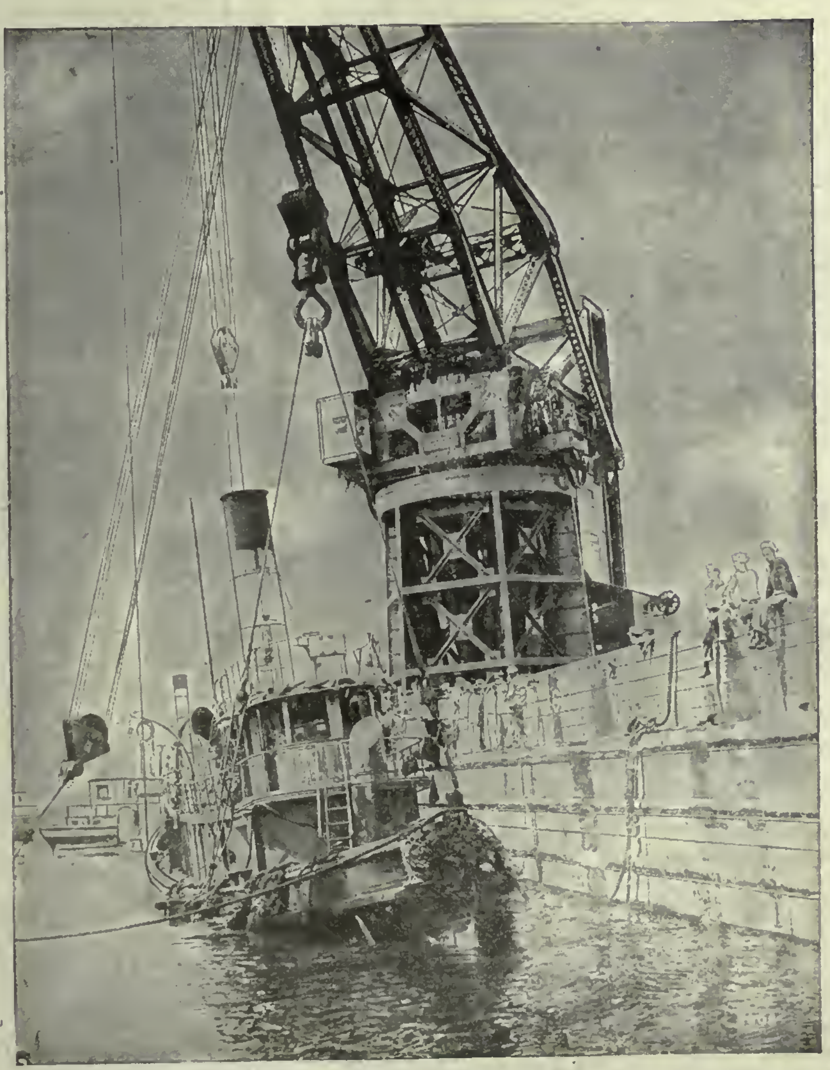

GENERAL VIEW OF PONTOON CRANE

tug, the crane rapidly and quickly lifted it to the surface as shown. Westinghouse motors driving the hoisting drums are shown in Figure 3.

It might be interesting to add that the Panama Canal Commission purchased two similar large cranes for heavy work. The cranes were purchased from a German corporation, but when the test load was applied (which was the same as applied to the crane shown in the illustration) it didn't pass muster. The first collapsed and was wrecked owing to a faulty design of structure.

The following data will give a good idea of the size of this machine. Size of pontoon, 140 ft. long by 85 ft. wide and 15 ft. deep, size of engine generator set, 150 KW; the crane has a main hoist consisting of two books of 75 tons, each fixed on the jib; an auxiliary hoist of 25 tons capacity movable up and down on the boom; the crane rotates in a complete circle, the rotating being controlled by two 60-HP motors; the boom luffs up and down from a practically vertical position to an angle of about 30 degrees from the horizontal in its lowest position; the luffing is accomplished by two 10-inch screws operated by two 60-HP motors; the main hoists can operate separately or simultaneously, as desired; when lifting the maximum load it is operated by two 60-HP Westinghouse type MC motors; the auxiliary hoist has separate motors for hoisting and trolleying, each of which is 60-HP, the counter-balance at the rear end of the crane is fixed, and amounts to 600,000 pounds; the total weight of the pontoon crane (displacement) is 5,000,000 pounds; the capstans are electrically driven, four in number, one at each corner of pontoon; the anchor hoists are steam driven, two in number, one at each end. The main pivotal bearing, or step bearing supports a ball or universal joint, and carries a maximum load of 2,021,000 pounds; the speed of the main hoist under maximum load is about 6 ft. per minute; the speed of the auxiliary hoist is 30 ft. per minute; the speed of the rotation is one revolution in four minutes; speed of luffing boom, entire range 12 minutes. The boom is of the cantilever type.

The Beach Foundry Company, Ottawa, Ont., is planning to expend about $75,000 on the erection of plant additions.



150-TON REVOLVING CRANE, RAISING SUNKEN TUG MASSASOIT

COURTS PERMIT SHIPS TO INSTALL WIRELESS

Ruling Means That War Urgency Is Greatest Thing At Present

MONTREAL.—Mr. Justice Bruneau dismissed the petition of the Marconi Wireless Telegraph Company, which asked the Superior Court to grant the issue of an interlocutory injunction to restrain the Canadian Car and Foundry Company, Limited, from installing certain apparatus for wireless telegraphy in ships under construction for the French Government at Port Arthur and elsewhere in the Dominion. To grant the injunction at the present time, in view of the facts that the ships are needed for purposes connected with the war would be against policy, his Lordship said: "The French Government wants these ships," he said. "It is a question of urgency. Any interference by this court in the manner asked would delay construction, equipment, and delivery of the ships. The respondents may be made to account for what they have done—but later on, after the war. To grant this injunction would be, in my opinion, not only a great political mistake, but nothing less than a crime against the French Government, without doing any practical good to the petitioner."

General Motors To Build. The General Motors Company, of Pittsburgh will build a $50,000 brick motor truck factory at London, Ont. Work is to commence shortly.

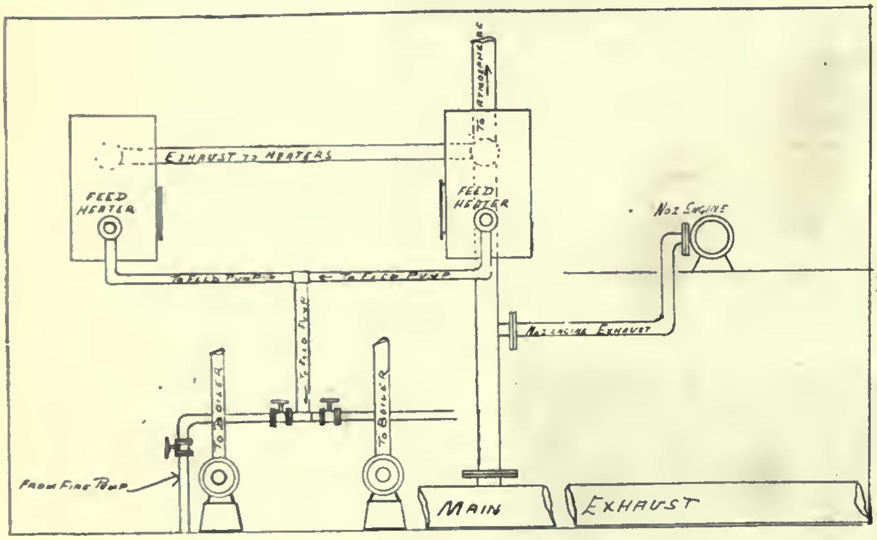
Plant Nearing Completion.—The new plant of the Lyall Construction Co., which is being erected in the east end of Montreal for the purpose of taking care of the big American order placed with the company some time ago, is nearing completion, and will be ready for operation in about a fortnight's time.

Hamilton Short of Gas. The gas shortage in Hamilton during the coming winter will be just as acute as it was last year. This was stated by E. S. Estlin, gas commissioner for Ontario, who was making an investigation for the Ontario Railway Board. Mr. Estlin urged that all citizens be asked to conserve gas to the greatest possible extent. He contended that those using it in furnaces were the worst offenders and would have to realize that conservation was absolutely essential. Mr. Estlin has made a survey of the number of industrial plants and business places using gas from the Selkirk fields and he found that there were 60. These had not yet been put on permits but this step would be taken at once, he stated. There are 150 applications for gas now on file at the office of the United Gas and Fuel Company, Hamilton. New consumers will not be taken on. Mr. Estlin instructed Mr. Byrnes that under no consideration would more consumers be added.

A DAY OF REST? IN THE POWER PLANT

By T. H. FENNER

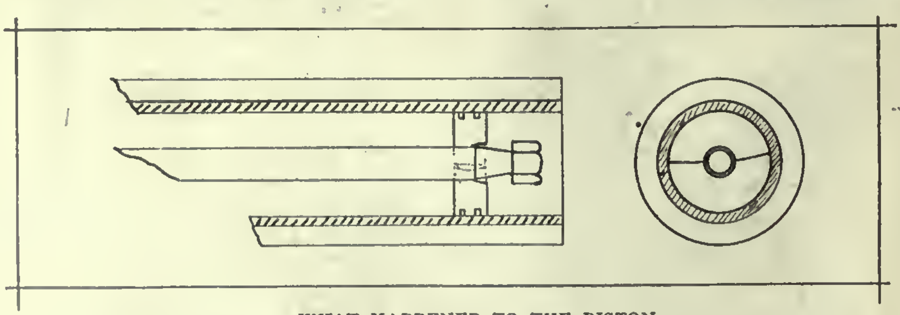
A SERIOUS and expensive breakdown occured to an 11"×9"× 14" high speed tandem compound engine under my charge in a peculiar manner. The accident occurred on a Sunday, when the regular engine room attendant was not on duty. As a matter of fact, no one was in the engine room at the time, the fireman on duty in the boiler room being under orders to come up and look at the oiling arrangements from time to time. To understand what happened we must have a glance at the boiler room, where the cause of the accident originated.



PIPING LAYOUT

The feed pumps took their water from overhead open heaters, of the Webster type, discharging through economiser to boilers. There was also a direct discharge to main feed leader direct, by passing the economiser, and also a direct discharge to an auxiliary header, as shown. The suction pipe from heaters to pump came down to a T between the two pumps, and branched off to each pump. There were also two independent suctions on each pump connected to hot and cold wells. On one of these suctions a connection had been made from the discharge of the fire pump for washing out boilers, and an emergency boiler feed. A branch was tapped off the auxiliary header at each boiler to connect tbe valve of the turbine hose for washing out. When washing out the fire pump was used, discharging through the feed pump suction, through the pump, and auxiliary header. The boiler room staff had stringent orders never to touch this fire pump valve, the engineer on duty in the power house being the only one authorised to make the connection. The reason for this care was apparent, as if the valve from the fire pump was opened and the suction from the open heater left open at the same time, the discharge from the fire pump would have clear access to the heater and from this to the whole exhaust system.

The day that the accident happened being a Sunday, in the ordinary course of events nothing would have been running. However a 50 h.p. armature had burned out on the Saturday morning, and the millwrights and electricians had been working Saturday afternoon and Sunday morning and were ready to try the motor after dinner Sunday. This would mean, if the repairs were O.K., about ten minutes running. Being anxious to know if everything would be alright for Monday morning, I decided to go down to the factory myself. The regular day engineer had been instructed to come in after dinner to run the engine as required, but as he had not shown up I started up myself, made the switchboard connections, and saw that the forced lubrication was alright. I told the fireman where I was going, and warned him to come up at intervals of not more than ten minutes, and look at the engine. I expected to be all through before he came up twice. However, some minor troubles developed in connection with the motor and shafting. A man was sent over to the engine room to see how things were and he reported everything alright. We got ready to start the motor again, and it started up this time perfectly, but after running about five minutes the motor started to slow down and the lights to dim. I started for the engine room on the run, but about half way there was met by the fireman, who informed me in quite a disinterested way that No. 1 engine had "gone to h—." He also volunteered the information that there was a lot of water in the basement. Arriving in the engine room, I saw a tangle of oil pipes, and the broken crank case lying on the floor, and at the same moment an ominous cracking broke on my ears. Coupling this with the fireman's statement of the leak in the basement, I made a rush for the feed pump, finding what I expected, the valve from the fire pump open, and the heaters and exhaust system flooded. The leak in the basement was the excessive overflow from the heaters backing up the water seal from the sewer. The next thing was to look at the water gauge to find the water just bibbing in the bottom nuts of the glasses on the two boilers that were working. I began to reconstruct things a bit in my mind, and then proceeded to catechise that picture of injured innocence, the fireman. The evidence being so complete, he could not deny opening the valves, but hedged a bit about the reason. However, I had a good idea of that, too, and on putting it up to him, he admitted the soft impeachment. He began the course of events by neglecting to watch his gauge glass, and when he did look, found the glass full, but how much more he knew not. However, he promptly stopped the feed pump, neglecting to shut the checks on the boilers. He then resumed his paper, being anxious to see how Foch was making out. Presumably he found the news to his liking, for when he next looked the water was about half glass. He congratulated himself on his excellent judgment in stopping the pump, and thought it would be all right now to start it up again. Here he struck a snag. The boiler checks not being dead tight, when the pump stopped some leakage occurred from boiler to pumps, resulting after a while in the pumps and heaters getting good and hot, too hot to handle water. Deciding that here again was a case for a good man to use his own judgment, he decided to pump some water through from the fire pumps, achieving the double purpose of feeding the boilers and cooling off the lines and pumps. He started up the fire pump, opened the discharge through the feed pumps, and left the main suction open. The water in the boilers did not rise, but it did somewhere



WHAT HAPPENED TO THE PISTON

else, and his ears were soon assailed by numerous strange noises. At the same time his gauge glass lamps started to lose their brilliancy, and it crept into his mind that something was wrong. He went up to the engine room just in time to hear a crash, and had then decided to go and get advice. His view of the matter was that it was decidedly unjust to spoil any poor man's Sunday by involving him in a series of untoward happenings that kept him in a state of nervous tension. Not having time to discuss the matter fully I went to ascertain the damage. I found both the crank pin and crosshead gib straps sheared off, the brasses themselves broken in several pieces, and all the oil piping twisted and broken. The cast iron crank case was also broken, though this was a detail. This was the outer damage. Next thing was to look for the internal troubles. The H. P. cover was removed and an attempt was made to move the piston ahead.. It was apparent at once that something was jammed, and jammed hard, as the hammer rebounded as though from an anvil. It was decided to take the nut off the end of the rod, and a spanner was brought for the purpose, but at the first application the end of the rod and the nut came away together, and it was evident that the rod had been ready to break. We then found that the piston came off the taper surprisingly easy, and after removing the piston from the rod a tentative tap with a hammer was tried on the end of the rod with the same result as before. The next step was to open up the L. P., and this achieved, the trouble was at once evident. The L. P. piston was cracked across, the crack being open from ⅛ in. to 3-16 in., and the piston had been forced over the taper into the parallel part of the rod, jamming on the walls of the cylinder. The only way it could be removed was to drill holes all round the boss and break a piece out, letting the piston come down on the rod, and relieving the pressure. The piston was then taken out in halves. The repairs necessary were new piston rod, new low pressure piston, new connecting rod end brasses, gibs, straps, cotters, and bolts complete, and oil piping, guards, etc., all of which was done at the factory.

Cause of the Trouble

What had happened was as follows: The water from feed pump had backed up through open heaters till they filled up to overflow level. The overflow took care of some of the water, but the level still rose till it came to the exhaust steam opening. Entering this it dropped down to the main heating exhaust and travelled along to the building. Presumably about this time the engineering genius in the boiler room, finding he was getting no water in the boilers, speeded the pump up a bit. There was some back pressure on the engine by now but the water had not yet reached the level of the cylinder. However, shortly after it did, with the results as named. When the final smash occurred the engine was just coming to the back centre. She must have been considerably slowed down from her normal 260 R. P. M., and was probably running about half that. The L. P. piston met a solid wall of water, and the energy of the fly wheel was enough to force the rod through the piston, splitting the piston and jamming everything hard and fast. The fly wheel still possessed considerable energy, the whole of which was applied to move the crank ahead, against the resistance of the immovable L. P. piston. The weakest parts were evidently the straps in crankpin and crosshead, and these parted. The fly wheel evidently made a few revolutions after this, as the connecting rod was thrown back near the front cover, and pieces of the bearing boxes were in the crankpit and on the floor, while the oil piping gave mute testimony of what it had gone through. The shock of the sudden stop on the H. P. end of the rod had to be absorbed by the piston nut, and this had evidently been too much for it. The metal had given, and the piston had loosened in the taper and was ready to let go at the first movement. This shows what can happen through one man's carelessness, and the guilty one should be susceptible to a more drastic punishment than being discharged as in these days being discharged holds no terror for the average fireman.

MANUFACTURING STEEL BARS FOR RIFLE BARRELS

(Continued from page 506)

are made out of chilled cast iron. Their length is 12 inches, not including that of the necks and wobblers. They are two-high, each one weighing about 350 lbs., and contain the following passes: One 1 1-4, one 1 3-16, two 1 1-8, one 1 1-16, and one 1 inch pass. When the bar comes from the ovals it is taken by the workman on the finishing rolls and inserted between guides, which are used to hold it in an upright position with the sharp edge of the oval bar facing upwards.

The worker, (called the finisher) then waits until the metal is between a cherry-red and a yellow color; then pushes the bar between the guides and into the groove. The heat at which the steel is rolled in the finishing rolls is most important—too high a heat auses the oval to over-fill the round groove, thus making it mark the bar at the joints between the top and bottom rolls. With too low a heat, the metal will not fill out the groove in the rolls, it making a bar of uneven size. The setting of the guides is also a matter of importance. If one guide is set further over on one side of the groove the bar will twist from that guide and have a flat side—it will also mark the steel on the opposite side. Should one guide be set higher than the other there will be a twist from the higher guide. If the oval is not quite large enough to fill up the round groove, there will be flat sides to the finished bar. If the grooves in the top and bottom rolls be not set exactly opposite each other, the bar will be marked on the sides. It will be seen from the foregoing that the rolls have to be set very carefully in order to make perfect bars. As rust is the great enemy of steel it is customary in some mills to pass their steel bars as they come from the rolls through a trough containing cuttings of fiber or leather saturated with tar —the vapor of which gives the hot metal a thin glossy coating. The roll turners' part in designing and turning the rolls is most important and complex. Rolls that work well in some mills will not do so in others, but have to be altered. This is due to the material used and also to the engine power and steam pressure. Attempts have been made to find quicker methods of making iron and steel bars, but all have been failures. It is most likely that nothing better can be devised to displace the use of rolls for making iron and steel sections, which are used extensively in all cvilized countries.

BANKER AS GATEMAN

Wealthy Man Working at Shipyard in Seattle

James K. Corbiere, for 40 years a banker in New York City, is employed as gateman at the Ames shipyards in Seattle. Mr. Corbiere is a man of wealth. He has never had to soil his hands by hard work. He is 60 years old, exceptionally careful in his dress, and equally careful of his health and appearance. His hair is snow-white. He seldom appears without a flower in his coat lapel, and usually wears spats and carries a cane. In every respect, age, dress and habits, he is different from the accepted style of the shipyard worker. He goes to work at 7 o'clock in the morning, two hours earlier than he has been in the habit of rising; is on his feet practically all day, and quits at 4.30 in the afternoon. He has been a personal friend of Charles M. Shwab, steel king, and now director-general of the Emergency Fleet Corporation, for 30 years.

When asked how it happened that a man in his station in life, when he felt the call to patriotic duty, did not undertake Red Cross work, or offer his services in some other capacity more nearly similar to that in which he had been so long engaged, Mr. Corbiere said:

"No: there are enough men seeking that kind of work. But it appeared that there was a real need for men in the shipyards, and I believe every man should help win this war."

When asked what he was earning at the shipyards, Mr. Corbiere replied: "I do not know. I have not called for my pay."

A San Francisco chorus girl held her job for seven weeks before the director found out that she was deaf and dumb.

The Story of a Pound of Coal

Explaining the Enormous Losses Occurring When a Pound of Coal is Burned Under a Boiler, the Steam Generated Used to Run a Steam Engine, and This in Turn Caused to Drive a Dynamo Supplying Electricity For Lighting

By H. W. SECOR, Associated Editor of "Electrical Experimenter."

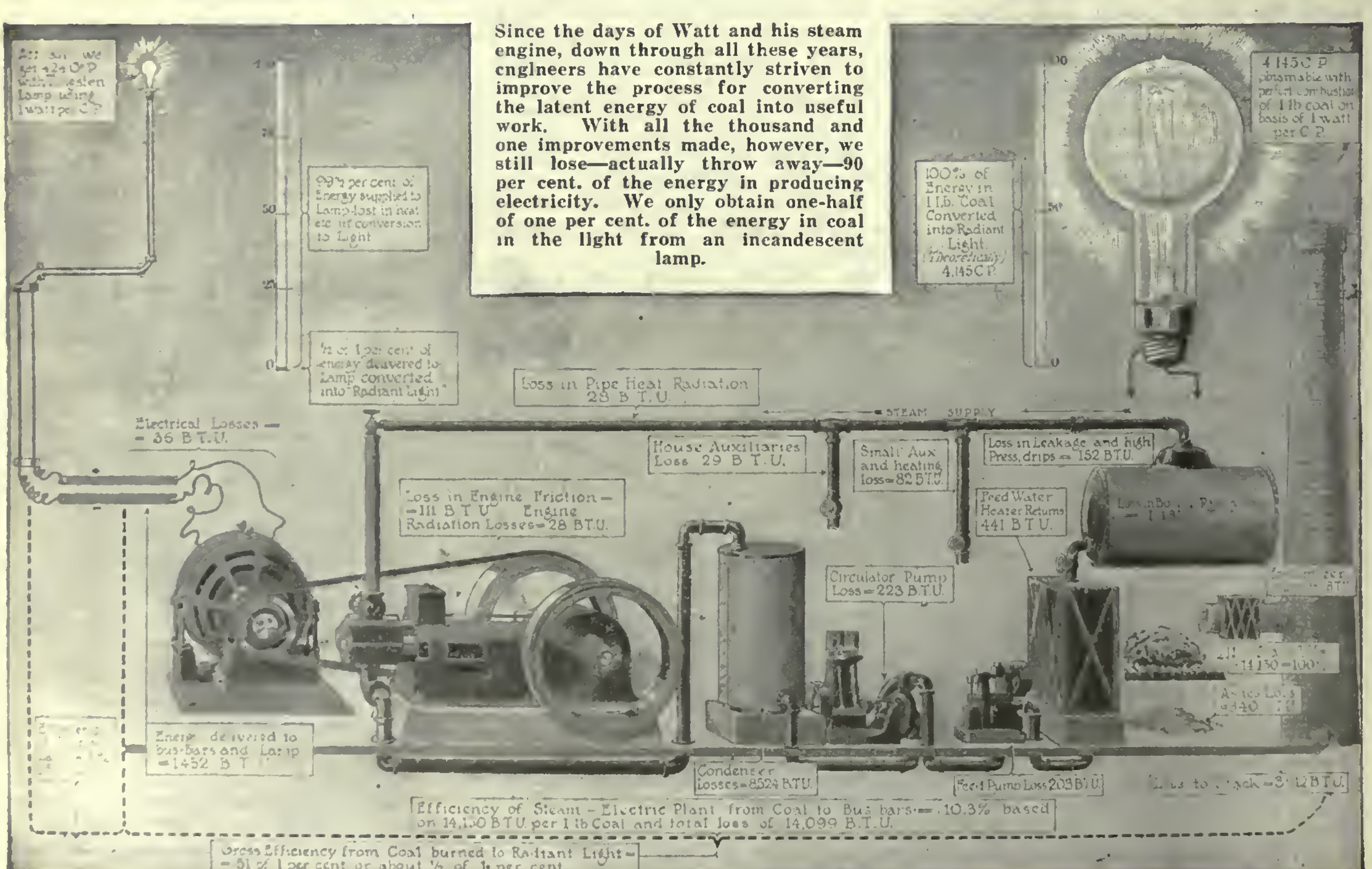
DID you ever stop to consider how much of the energy present in a pound of coal is actually converted into electrical energy, even in the best power plants of to-day? In a few words it is this—that out of every pound of coal burned in a steam boiler in an electric power station we only succeed in converting about **one-half of one per cent.** of the total energy in that pound of coal into radiant light! The average person believes that in this so-called "electrical age" we have reached well-nigh perfection, but the above figure illustrates vividly that the electrical and steam engineers have many problems yet in front of them before anything like real efficiency is attained in converting the energy in coal to **electric light**, or for that matter into **electrical energy** with which to feed the lamps and other apparatus. For the largest and most highly developed steam-electric plants of to-day do not realize an over-all efficiency of much above **ten per cent.**

This figure of ten per cent. represents the ratio between the coal burned in the boilers and the current delivered by the dynamos to the bus-bars, and shows that what most persons believe to be a wonderful and highly efficient electric power generating station is really throwing away about 90 per cent. of the energy in the coal it buys.] A modern water-power electric generating station may show a gross efficiency of as high as 56 per cent.; therefore there is something radically wrong with our coal-burning methods, beyond the shadow of a doubt. Several well-known inventors have ventured to design a different type of apparatus for developing electrical energy direct from coal, but so far no commercially successful method has been perfected. Even Edison has tried his hand at perfecting such a machine, but so far we have not advanced beyond the well-known boiler and fire-box stage in our commercial utilization of the energy in coal.

Therefore it is of interest to study this important subject a little and to find out where this enormous loss takes place. The accompanying illustrations show in a graphic manner just where these losses occur in each part of the system of a modern steam-electric plant. The various losses and efficiencies are taken from a report made in the transactions of the **American Institute of Electrical Engineers** by a well-known electrical engineer, Mr. H. G. Stott, and represent the efficiency of a large steam-electric plant. Some of the large present-day plants of this type obtain a slightly higher over-all efficiency than the one here cited, for instance, the Interboro Rapid Transit Company's plant in New York City showing a gross efficiency between coal burned and electricity developed, of about 12 per cent.

Let us now resume the discussion of the present steam-electric plant here illustrated. In looking at the illustration from right to left, keep in mind the energy in a pound of coal at the start, viz., 14,150 B. T. U. (British thermal units.) One B. T. U. is the amount of heat required to raise the temperature

(Continued on page 526)



Since the days of Watt and his steam engine, down through all these years, engineers have constantly striven to improve the process for converting the latent energy of coal into useful work. With all the thousand and one improvements made, however, we still lose—actually throw away—90 per cent. of the energy in producing electricity. We only obtain one-half of one per cent. of the energy in coal in the light from an incandescent lamp.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

THE CLEVELAND MILLING MACHINE

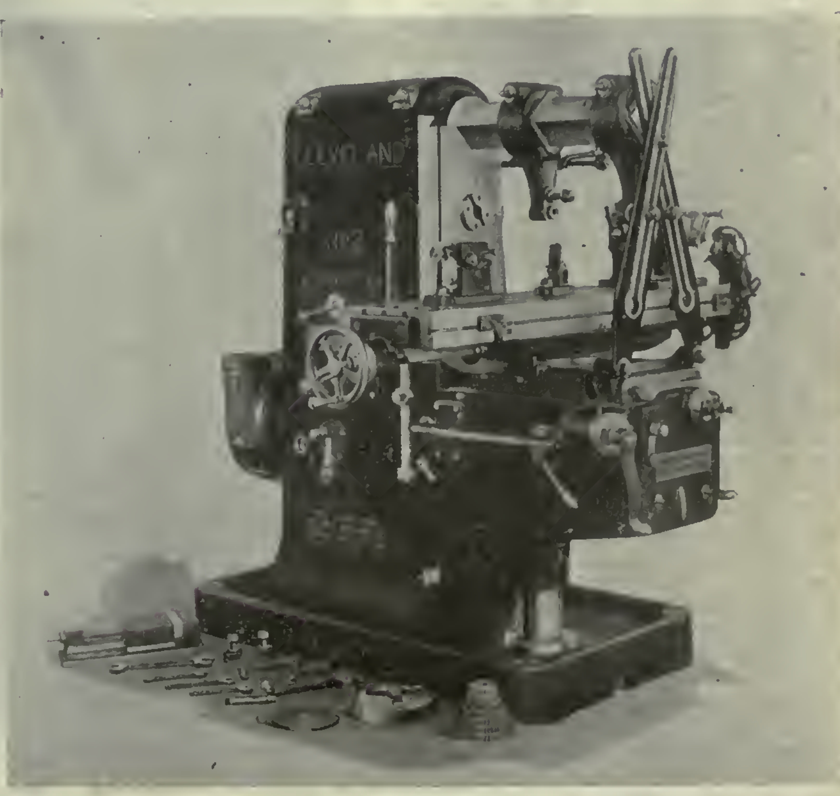
THE accompanying illustration shows the Cleveland milling machine developed by the Cleveland Milling Machine Co., Cleveland, Ohio. In the design of this machine, structural features have received great attention, and the operating characteristics lend themselves to ease in operation and quantity production.

The Cleveland milling machine is a constant speed driven type with sixteen changes of spindle, and sixteen changes of feed. Speeds and feeds are controlled by two levers of the ball-joint type, similar to an automobile gear shift. All changes for both speeds and feeds obtained through sliding gears only. Both are automatically lubricated.

The column is of very rigid construction, being a complete box section. The base and the column are in one piece, a heavy ribbed semi-steel casting being used, tied together with heavy vertical and horizontal walls. The only openings in the column are those necessary for the change gear levers on the front, the pulley drive housing in the rear and the cutter lubricant tank on the left side of the machine. It never becomes necessary to open up the column, as all the parts inside are automatically lubricated, and all adjustments on the bearings are made from the outside. The dovetail knee slide extends upwards to the overarm. This offers ample surface for clamping attachments. The depth of the column has been carefully determined in order to place the spindle and the shaft bearings at the correct distances apart to secure the maximum rigidity. On account of the design of the horizontal and the vertical walls to separate the lubricating oil for the machine from the cooling compound used for the cutter, the column is very rigid. The base of the machine is ample in size. Transverse and longitudinal ribs tend towards rigidity. It is also finished on the under side so it will stand solidly on its foundation. The base is pan-shaped and has enough depth to catch oil and chips, thus keeping the surroundings clean.

Next in importance to the column is the knee. It is therefore necessary that the knee be especially designed to withstand all the weight that is put upon it in doing heavy work. The knee as well as the column has an improved dovetail slide. The bearing of the saddle is not on the thinnest section of the dovetail slide, but on the flat wide surface. The narrow slide acts as a guide only. There is no bearing on the center of the dovetail slide. This eliminates chances of having same marred by the operator laying wrenches or tools on the top of the knee. The bearing of the knee on the column is carried well above the top of the saddle slide, thus giving the knee a longer bearing on the column and reducing the bearing pressure to a minimum. The feed box as well as the knee is entirely closed, eliminating any possibility of chips getting into the feed mechanism. The elevating screw is large in diameter, and in one piece. The post acts as both support to the elevating nut as well as a guide in the knee. The screw is operated with a double bevel gear, hand feed and power feed being independent of each other.

With the table and saddle of all milling machines comes a most trying problem for designers of machine tools, as these are subject to torsional as well as bending movements. The table is machined all over, to keep its alignment, as it has been proven that a table finished only on one side is liable to warp, on account of the internal strains. The bearings on the table are at the top of the saddle instead of at the bottom of the dovetail. This method secures a large bearing surface and locates the bearings at greater distances apart. These bearings are automatically lubricated by rollers in the saddle. The bearing on the saddle is also at its widest portion, and both saddle and table bearings are taken up with long taper gibs which are provided with adjusting screws at both ends to make up the wear.



CLEVELAND UNIVERSAL MILLING MACHINE

The square overarm provides positive alignment of its arbors and maximum rigidity of the arm pendants. If the arbor is not exactly true and the arm pendant is brought into place by the operator to accomodate the arbor, the arbor under these conditions is working in a cramped condition and will shortly be crystallized and break. With the square overarm it is impossible for the operator to place the arbor supports on the overarm and on the arbor in any other way than exactly in line. The square overarm also enables work to be placed on the table and be fed in a vertical position past the overarm. Owing to the firmness which the square overarm imparts, a greater variety of work can be performed than would be otherwise possible.

A flanged spindle eliminates the overhang end of the spindle as well as the trouble caused by cutters screwing fast on the spindle and also allows the cutter to be run in either direction. On the flanged spindle is a face keyway, inserted into which are hardened steel jaws for driving the arbor as well as the face mills. It is unnecessary to remove these at any time to change from the face mill to an arbor, as the driving is done by the hard steel jaws. The strain is therefore taken off the taper hole to drive the arbors. The spindle is provided with a positive lock that enables the operator to loosen the arbor nuts with the least possible difficulty. The spindle lock cannot be operated while the machine is running, nor can the main driving clutch be thrown in while the spindle lock is in this position. The bearing on both the front and rear end of the spindle is taken up with a nut on the outside, at the back end of the spindle.

All bearings in the column and knee are flooded with lubricant, thereby taking the responsibility for oiling the important parts of the machine off the operator entirely, and eliminating the necessity for having oil holes in any of these members. This system is highly efficient and is entirely automatic. The reservoir containing the oil has to be filled but twice during the year. Embodied in the design is a centrifugal pump which operates only when the spindle does, therefore it is necessary to shut off the cutter lubricant when changing work or measuring same. This operates automatically when the clutch is thrown in starting the machine.

The speed and feed arrangement are both of the sliding gear type. All sixteen changes of spindle as well as feeds are made by two levers conveniently located to the operator. The spindle speeds are sixteen in number, in either direction, and the feeds are sixteen in number also, so that this machine will efficiently handle all classes of cutters, speeds and feeds, and being in geometrical ratio, gives the correct changes of feed for the work to be done. All gears and shafts in the drive as well as the feed are hardened steel, automatically lubricated, running in bronze bearings.

Power is transmitted through a constant speed drive pulley and is so designed that it requires no loose gears on the spindle. All shifting of gears is done on the secondary shafts below the spindle. The starting or stopping lever can be operated from both sides of the machine. The single pulley running at constant speed for the drive is protected by a belt guard and is so constructed that it can be adjusted to any angle and extensions can be added to it. The spindle reverse is contained within the machine so that right or left hand cutters can be used on the machhine. All the speeds, feeds, and other driving mechanism is self-contained within the machine, it not being necesary to have any driving mechanism bolted on the outside of the column of the knee.

METAL SAWING MACHINE

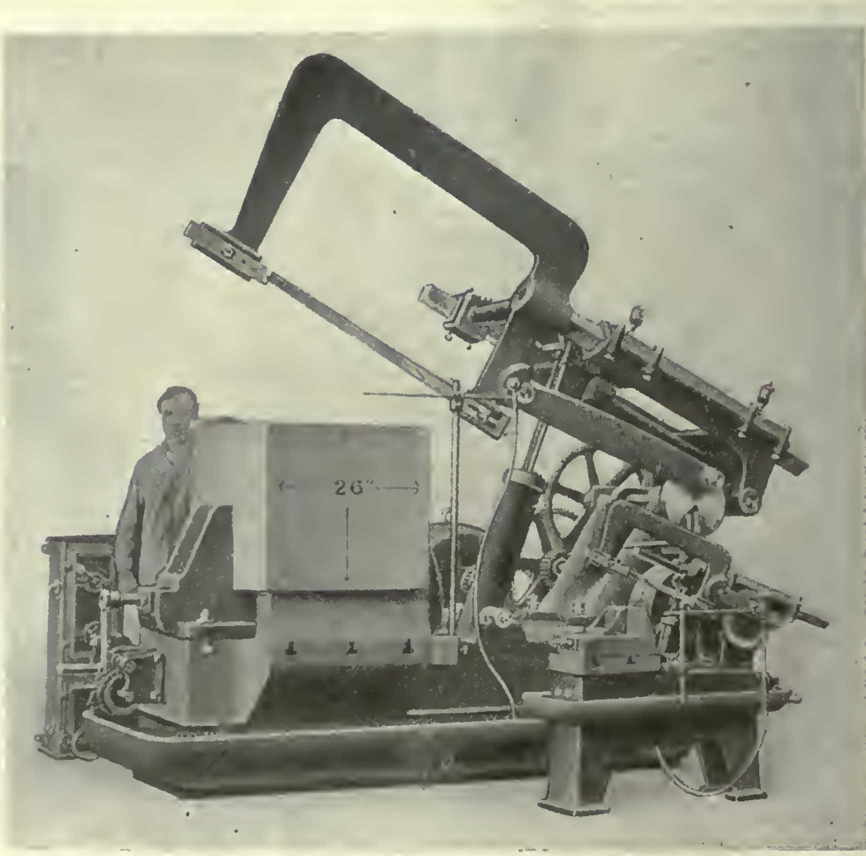
The hack sawing machine illustrated by the enclosed engraving is one of the largest machines of this type that have been made. It weighs 3½ tons and will saw through a billet of oil hardened gun steel 26 inches square. The machine was specially designed and made for one of the Royal Naval gun factories in the north of England by Messrs. Edward G. Herbert, Ltd., Atlas Works, Levenshulme, Manchester.

This firm was one of the first to appreciate the possibilities latent in the old Millers Falls hack saw and, by the production of heavier quick cutting machines, elevated the hack saw to the position of a real production machine tool, competing with, and frequently replacing circular and band sawing machines.

The general design of the machine is similar to that of the "Rapid" sawing machines made by this firm. The saw frame is 3 feet deep and 5 feet wide over all and takes blades from 24 inches to 39 inches in length and 2 inches wide. The main slide bearing is 3 feet 6 inches long and the main driving shaft 3 inches diameter. The slide is pivoted on a separate shaft. The heavy frame is counter-balanced by springs in the bed of the machine and the pressure of the saw blade on the work is regulated by a worm wheel and indicated by a dial. The saw blade cuts on the outward stroke and is lifted from the work on the return stroke. Although the weight of the frame is considerable the blade is lowered on to the work at the commencement of the stroke without any shock.

The saw frame can be raised and lowered by hand through worm gearing at the front of the machine. The worm is dropped out of gear when cutting begins and the feed is by gravity. In the same factory there are five No. 3 motor driven "Rapid" sawing machines, sawing up to 15 inches diameter, these being the largest machines previously made by Messrs. Edward G. Herbert, Ltd. They are engaged in sawing test pieces from oil hardened gun tubes and jackets.

All six machines are looked after by one unskilled man and a woman. One saw blade will cut through the 26-inch square billet and still remain serviceable. The motor fitted is a 3 H. P. 2/1 variable speed motor made by the Lancashire Dynamo & Motor Co., Ltd.



Procedure Regarding Export Licenses

Effort Being Made Now to Simplify the Rather Intricate System That Had Come to be Used in War Order Business—Lists of the Lines That Are Affected by the Order

WASHINGTON.—1.—The War Industries Board and the War Trade Board announce that they have jointly adopted the following rules and regulations for the purpose of simplifying the procedure of obtaining export licenses from the War Trade Board, priority certificates from the Priorities Committee of the War Industries Board, and permits from the director of steel supply of the War Industries Board.

2.—The War Industries Board announce the withdrawal of its regulations as set forth in P. C. Form No. 18, July 3, 1918, paragraph 6, requesting that applications for licenses to export iron or iron and steel products should not be filed with the War Trade Board unless the orders are covered by either priority certificates or permits from the director of steel supply.

3.—On and after October 14, 1918, applications for licenses to export any article on Schedule "XP," annexed hereto, should be filed with the War Trade Board, and must include the following papers properly executed:

(a) One application, Form X, to which should be attached:

(b) One each of such supplemental information sheets as may be required by the rules and regulations of the War Trade Board to be used in connection with shipments of certain commodities and shipments to certain countries, and

(c) New supplemental information sheet, Form X-26, which will be ready for distribution by the War Trade Board on and after October 14, 1918.

4.—Applications which have Form X-26 attached will not require Form X-2.

5.—The Priorities Committee of the War Industries Board has awarded priority classification "C" to all articles (on which priorities are issued) which are on the export conservation list of the War Trade Board and are covered by export licenses issued on and after October 16, 1918. No class "C" certificates will be issued with such licenses. If the article specified on the licenses is one on which priorities are issued, and if no individual priority certificate accompanies the export license, the license itself will be evidence that the articles covered by it have been automatically awarded priority classification "C."

6.—Export licenses issued on and after October 16, 1918, under these regulations. covering commodities on which priority certificates are issued, will be accompanied by individual priority certificates of the Priorities Committee when in the opinion of the Priorities Committee a higher rating than Class "C" is of the Priorities Committee a higher rating than class "C" is warranted. These priority certificates will be issued by the Priorities Committee and forwarded with the export license without further request from the applicant.

7.—Export licenses issued on and after October 16, 1918, for the exportation of iron or steel or the products or manufactures thereof, which are not covered by priority classification, will in themselves constitute a permit and approval from the director of steel supply for the filling of the orders for the quantity of iron or steel specified in such export license to the extent that such delivery will not interfere with the delivery when and as required of orders covered by priority.

8.—It is the policy of the War Industries Board and the War Trade Board to discourage and prevent exporters and manufacturers from purchasing, manufacturing, or producing articles on the export conservation list for the fulfillment of specific export orders until an appropriate export license has been issued. Instances have come to the attention of the War Trade Board in which manufacturers before obtaining export licenses have manufactured articles foi specific export orders, which articles, while useless for domestic consumption, could not under the regulations of the War Trade Board be exported. It is essential for the proper conservation of commodities in the United States that this practice be stopped, and it is the purpose of the War Trade Board to refuse licenses to exporters who do not conform to this policy.

9.—The Priorities Committee announces that it undertakes where necessary to administer priority in the production of all raw materials and finished products save foods, feeds, and fuel. The preference list promulgated by the Priorities Board forms the basis for the distribution of fuel. Priority is being administered generally on iron and steel products, copper and brass products, electrical equipment, and the products of which any of the above form an integral part. Priority is not being administered at this time on lumber or lumber products, paper or paper products, chemicals, brick, cement, lime, hides, pig tin, tin plate mine products, and numerous other items which cannot well be enumerated. It is not possible to prepare lists in detail covering either prioritied or nonprioritied products, and even in those mentioned above exceptions will from time to time occur. Any inquiries with respect to the commodities upon which priority is being administered should be addressed to the priorities committee of the War Industries Board.

VANCE C. McCORMICK,
Chairman.

Schedule XP, Referred to Above

Pig iron.

Ferro-silicon.

Spiegeleisen (frequently described as specular iron and mirror iron).

Iron and steel: Scrap, ingots, billets, blooms, slabs, sheet bars, skelp, wire rods, alloy steel, high-speed steel, tool steel, bars (including flats 6 in. wide and narrower); hoops and bands (including hot and cold rolled strip steel); shapes (including beams, angles, channels, tees and zees); fabricated structural steel (including beams, angles, channels, tees, zees, or plates ⅛ in. thick or heavier, punched or shaped, including tanks made of plate ⅛ in. thick or heavier). Plates (all classes ⅛ in. thick and heavier and wider than 6 inches, and circles over 6 inches in diameter. This includes No. 11 U. S. gauge but not No. 11 B. W. gauge). Sheets (all classes under ⅛ in. thick). Boiler tubes, mechanical tubes, boring tubes, oil well casing, line pipe, drive pipe, cast iron pipe, wrought iron and steel pipe, poles, wire rope, cable and strand, consisting of 6 wires or more, rails and splice bars, frogs and switches, railroad tie plates, railroad track spikes, railroad track bolts, boat spikes, wire, wire nails, wire spikes, cut nails.

Never Meant for Scrapping

A scrap iron dealer in Harrodsburg, Ky., recently bought from an old colored "Auntie" an old-fashioned iron stove which evidently had been made in the early days of stove manufacturing. A big door in it could be raised to let in andirons on which wood for the fire could be placed.

When men in the dealer's yard started to break up the stove they found that the iron was nearly an inch thick, and they tried in vain to wreck it with heavy sledgehammers. Finally the stove was sold intact as an antique.

Steel Workers in Service

The United States Steel Corporation's service flag now shows 25,985 men from its plants are in the army and navy. The corporation has word so far that 60 of its former employes have been killed at the front.

Companies Incorporated. Incorporation has been granted to the following: Mabee Condensed Milk Company, Ltd., Toronto, capital $1,500,000; The P. Q. Towing Company, Ltd., Dalhousie, N. B., capital $50,000; Petrie Manufacturing Company, Ltd., Hamilton, capital $2,000,000; Consolidated Machine and Tool Company, Ltd., Brantford, $500,000.

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Clipping Coupons Is Profitable.

THE army of coupon clippers in Canada is growing. Not long ago the term "bond" used to scare people. It wasn't something that the average individual had anything to do with. It had an atmosphere of private offices, ease and luxury that belonged only to those who had made their wad.

But of recent years there have been a heap of people in Canada who have found out from actual experience that a bond is a mighty fine little thing to have around the premises, and also that coupon clipping isn't a very painful operation after all.

The public has come to realize that lending money to the Government at a little over five per cent. is away ahead of buying oil stocks, mining securities, or taking a chance at industrials that may go or go under.

And it's that feeling that is going a long way toward making the Victory Loan a success. The Loan is attractive apart from any patriotic appeal that can be made on behalf of it. It is tax-free. It ought not to be, but it is. The Government should never have started this form of tax dodging, but having started it, it now fears to jeopardize the success of the issue by making it liable to taxation. The purchaser of Victory Bonds gets the benefit of the early course, mistaken though it was.

The Canadian mechanic need not hestitate about putting his money into the war loan. He can afford to strain a point in paying for his bond. Take it as a hard business proposition, apart from the patriotic considerations, apart from what it means to Canadian business—the Victory Loan is an investment chance that does not come often. The man who has not invested before should get his schooling in this good thing.

German Money a Real Boomerang.

THERE'S one man in United States who has broken all records for buying bonds. The way he tosses out millions for the Liberty Loan would make Carnegie or Rockefeller gasp and reach for the railing to keep from being swept off the deck.

His name is A. Mitchell Palmer. Already he has bought $60 000.000 worth, and he's still going strong. If you want to know how it's done, here's the explanation in Mr. Mitchell's own words:—

"Possibly I have some little right to be a Liberty bond salesman, if there is any merit in the maxim "practice what you preach," because they tell me I am the biggest buyer of Liberty bonds in America. I have got something like $60,000,000 worth, and it is a poor day when I don't subscribe for $1,000,000 more. For me it is an as well as a pleasant task because I buy Liberty bonds with the Kaiser's own money."

It so happens that Mitchell is Alien Property Custodian of United States. Here's how he operates.

"Why some few weeks ago, out in a western city, a school-teacher who was a German-born woman. died, and in her will she bequeathed $10,000 to von Hindenburg. I got that. I invested it in Liberty bonds and the proceeds were used to buy ammunition, and now Pershing's boys are trying to deliver the legacy to von Hindenburg over in Germany.

"We have made every dollar of German money in America fight the Germans. Great iron and steel mills, which were wont to send their profits out of America back to Germany, are now sending their profits to the Treasury of the United States and their product into war munitions to destroy their owners.

"Great woolen mills over in New Jersey, which were wont to send large dividends back to Berlin, are now sending those dividends to Washington, and working every loom and spindle to make those Army suits for the boys with Pershing in France.

"Great metal, mining, and mineral companies all over the United States, owned with German money, are working night and day, three shifts to the day, to produce material, not for the German over here to plant his industry in our midst as a sort of spy system against us, but for the United States, which he sought to destroy."

It is well to realize that war is not play. It's plain hell, and a nation must handle it in that way. Love taps don't fizz on the German either on the western front or in this country. Politicians are gradually coming to the stage where they know the German hasn't got a vote just now, and they're licked if they stop to reckon about the votes he may have in years to come.

Well, Here's Your Chance Now

WHEN pay is good and work is thick and things are runnin' smooth, when there ain't no bumps nor kinks to hurt the slidin' in the groove—when all them things is happenin', boy, when you're a man of means, why don't forget to now and then put a ten into your jeans.

It's easy for to take your cash and fling it far and wide, to put fresh fixin's in the house, new duds upon your hide.

There ain't no end to things to buy, vou've found that bloomin' store. You'd like to cut a swath, me boy, that's out before, these things they beckon on to you in every sixteen yards across, and doll yourself to be the likes of some ten thousand boss. .

But just remember all the same that fat pays come and go, that after summer comes the fall and trailin' that the snow.

It's nice to spend, we all know that, it aint no trick at all, to flash your dust at every curve and toss to every call. It sometimes takes a little nerve to stay upon the sod and quietly sprout another ten unto your little wad.

But here's the time, me boy, to take and blow your bloomin' pile, and stick your chest six inches out and hatch a wholesome smile. Yes, here's your chance to stake your cash in somethin' good as gold, that wouldn't grow stale upon your hands nor yet grow stale with mold. And here's your chance to help the boys what's gone across the pond—by buying deep and long and loud that good old Vict'ry Bond!—ARK.

AFTER all said and done it's a great thing to mind your own business.

* * *

PUTTING the hell into shell is really the work of the munition plants at present.

HARD WORK AND HARD STUDY DID IT

Arthur A. Hopkirk Wanted to Drive a Locomotive When He First Entered Shops.

SIX years ago an unassuming young man earned one hundred and twenty-five dollars a month. To-day his monthly salary is four hundred dollars plus. On pay days he signs five hundred and seventy-five cheques. Above his signature is the firm name Universal Tool Steel Company. Below his signature is his official title, superintendent. Arthur A. Hopkirk is his name in full, but his signature is simply A. Hopkirk. Better reasons for our saying he is unassuming could be told.

ARTHUR A. HOPKIRK

One is that he confessed to having been a messenger boy the first year or two after leaving public school. Out of his earnings as a messenger he saved enough to pay his own way through one of the business schools.

Figuratively speaking, it was only a step from the school to an insurance office. Typewriters rattled and bond papers crackled and routine wove its web. Something in Hopkirk rebelled.

The general master mechanic of the C.P.R., West Toronto shops, lived across the streets from his home. One day he asked the father of young Hopkirk what he was going to do with his boy.

"You'll have to be more definite," the father of seven boys smiled.

But the boy meant was ripe for any change that would take him away from stiff-collar monotony.

Variety thrived in the general master mechanic's office. So did young Hopkirk. There were men in and out that knew a joke. There were yard engines and spare moments to be spent in their cabs.

Perhaps those rough and ready, but verily salt of the earth, railroaders, were good guessers or perhaps they were not. However, that may be, they knew nothing of the sizable ambition squelched by their answers to the questions Hopkirk put with seeming unconcern. At the end of a year he knew the worst. He could never be the proud driver of a locomotive. His eyes were not long-sighted enough.

He had not shared his ambition with a soul. Neither would he share his keen disappointment. He was a shy, studious lad with inner thoughts that he could not bring himself to tell.

After a year and four months in the general master mechanic's office he went into the shop proper, and for five years he served as an apprentice.

In the fourth year of his apprenticeship, when making seventeen cents an hour, he married the world's most courageous girl. At least so he thinks of her now when thoughts go back to their two-roomed home.

The next year he finished his apprenticeship and went with the Canada Foundry where he commanded journeyman's wages right away. But six months later the C.P.R. West Toronto shops offered as good pay, and he returned.

"I worked three more years in those shops, studying in my spare time," he told me. "I took a correspondence complete course in mechanical engineering. About this time, too, your technical papers had a good deal to say about shop efficiency. As well as reading all I could find on the subject I made time studies in relation to production myself.

"I guess some of the men thought I was a nut, but I knew what I was doing and tried to be indifferent to their talk while continuing my studies.

"Just before the three years were up I wrote S. J. Hungerford, general manager of the C.N.R. I told him what experience I had had, the progress made in my studies, and that I thought possibly a young man would stand a better chance for quick promotion in one of the western shops of the C.N.R.

"It wasn't long after that A. Dickson, then our general foreman, came to me with a letter from A. E. Eager, shop superintendent of the C. N.R. at Winnipeg. Eager wanted to know if I had any right to be so ambitious, and Dickson evidently told him that I had.

"So I went to Winnipeg as C.N.R. shop engineer. I went on trial for three months at one hundred and twenty-five dollars a month, but I stayed three years.

"And it is now three years since I returned to Toronto. Galloway preceded me by no more than a week or two. He came East to accept the superintendency of this plant. I came to act as general foreman.

"We started on eighteen-pounder shells. Our second contract was for eight-inch. Then we switched back to the former, and since the first of the present year we've been making six-inch howitzer. Each change entailed a rearrangement of the plant, and that was no cinch," the speaker said emphatically.

Six months ago Galloway was made general manager of the J. J. Carrick plant at Buffalo. Arthur A. Hopkirk, thirty-seven years old, was given his private office and all that goes with it. He speaks modestly of his success, but if you are a young man and sincere, he will tell you that hard work and hard study put him where he is to-day.

SIR THOMAS WHITE,

Finance Minister, of Canada, who has given lucid explanation of the Victory Loan.

MARKET DEVELOPMENTS

New Regulations Are Causing Some Concern

French Experts Have Very High Opinion of Efficiency of Canadian Shell Shops—All Steel Materials Will Likely Come Under Government Observation and Control

THE warehousing business in Canada is surely coming to the point where it works in rather uncertain channels. For a long time material of less than ⅛-inch in thickness was not included in the embargoed list, and firms that had a good connection at U.S. rolling mills had little trouble in "carrying on." Even when the War Trade Board turned down an application for the release of certain material—particularly plate—they often did so with the recommendation to "use some lighter material." This provided an easy way out, but now this lighter material is under the same ban.

Canadian shops maintain a very high standard of efficiency on shell work. A party of French mechanical experts are in Canada at present, under the guidance of an interpreter from the Dominion government. They have been in United States for some months in connection with French orders. They state positively that in point of production and the well-planned arrangement of the sequence of operations, Canadian shell shops are absolutely the best in the business.

Inquiries for equipment in machine tool circles are mostly for 155 m.m. contractors. Those shops that are producing now are in much better position to add, piece by piece, to increase their output, than new plants are to go out for an entire outfit. Dealers have odd machines on standing orders, and delivery in this way is comparatively rapid.

Supplies were sent forward this week for the mechanical equipment that is to accompany the Canadian expeditionary force to Siberia. Apparently nothing is being lost sight of that will be needed to make the force self-sustaining as far as repairs are concerned. Shipment was made to the embarking point at Vancouver.

United States War Industries Board has given notice that the manufacture of lawn mowers will have to be curtailed for the present.

Scrap metal dealers are having an off month. All those who have any stock on hand are apparently looking for purchasers, but purchasers are few. As a matter of fact, a large amount of this business passes directly from seller to melters, to the exclusion of the dealers.

NO PANIC EXPECTED WHEN PERIOD OF RECONSTRUCTION DOES ARRIVE

Special to CANADIAN MACHINERY

MONTREAL, Que., Oct. 31.—Few industrial activities have been directly affected by possibilty of an early termination of European hostilities. Some signs of this though are apparently not pronounced, but the impression may be gathered from the remarks of those who are in a position to know and that period of readjustment may come at almost any time. However, it is the opinion of many that any likelihood of a panic will be avoided by the operations of the War Trade Boards, as it is believed that these bodies will continue to regulate and control the situation for some time after peace is declared. The demand for machine tools is a little quieter and dealers report this due to the peace movement now on foot. Plants working on American orders, however, are losing no time completing their equipment, as it is intimated that the temporary lull will be shortly followed by increased activity. Operations on the new plant of the Canada Cement Co. have been temporarily suspended, owing to the fact that some change may be made in the size of shell to be manufactured. Industrial work in this district is still affected by the influenza scourge and output has been interfered with; during the past three weeks the Canadian Vickers plant has had over 500 men affected.

Less Demand For Futures

The dominating feature of present activity is the apparent nervousness that prevails in many circles. Frequently this feeling is partly hidden in the announcement that the war will last for a long time yet, but the atmosphere is so full of uncertainty that early future predictions are virtually impossible. The general steel situation shows little change over the past few weeks, but more reluctance is evident in the placing of orders for future requirements, and many of those placed are done so subject to such conditions as may exist at time of delivery. An influencing factor on present transactions is the fact that U. S. Government requirements are being placed with the mills subject to cancellation, providing the same will not materially affect the operation of the plant. Early future conditions hinge on the outcome of the present movement for an armistice. Should current negotiation end in a cessation of active warfare it is more than possible that certain industries will be curtailed to meet the changed conditions. The first to be affected will doubtless be that of steel and in particular that branch related to munitions. However, it is not anticipated that any sudden collapse will follow, as it is thought that the intention of the Government War Boards is to maintain a state of equilibrium while a gradual return to normal is attained. This action is not only advisable, but essential, in view of the vast increase in production facilities during the past three years. Under no form of control the market would rapidly assume a panicky condition, which would be detrimental to future prosperity. The demands for material for present and immediate future needs are still insistent, but a notable decline is reported in the orders that are being placed now for 1919 delivery. This attitude will likely continue until some definite announcement as to Germany's intentions is known. Little consideration is yet given to ordinary steel requirements, as essential operations are still sufficient to absorb all the available material. The local situation remains unchanged and the attitude of the dealers here is one of watchful waiting. Present quotations are only a guide to existing conditions, as purchasers are advised that in the majority of cases the prices are only of a nominal character.

Metals Are Easier

General conditions are having the effect of making the metal market easier and price quotations are declining. Present peace possibilities and the unsettled condition of the trade is the influencing factor, and as a consequence, buyers are acting cautiously in covering their future requirements. Should the war terminate in the near future it is thought that quotations on some of the metals would show a marked falling off, notably spelter and lead, and probably tin. Copper will be less affected owing to the strict regulations now governing the sale and distribution of the metal. Dealers here are now asking 31 cents for lake and electro and 30½ cents for castings. Tin, which was quoted at about 95 cents last week, is now 90 cents. Spelter shows a slight decline, the current quotation being 10½ cents per lb. Antimony at 15 cents is a decline of one cent per lb. Aluminum quotations are about 46 cents per lb.

Tool Trade Affected By Peace Talk

It is quite natural to assume that uncertainty will upset the operations of any enterprise and this appears to be true in respect to machine tool activity. During the past two weeks there has been a noticeable decline in the placing of orders for future delivery, as many buyers are reluctant to purchase under present unsettled conditions. This peace talk, however, has had little effect on manufacturing, as tools now on order are still urgently needed, and it is not anticipated that any letting up will take place until something definite has been decided on. One dealer here goes so far as to intimate that in another month everything will be going full swing again, on the supposition that present negotiations will not end in a satisfactory settlement. Nevertheless, the tendency in all directions is to retrench in the matter of covering future needs. Dealers in small supplies and tool steels report a slight falling off in the demand, particularly for large lots.

Little Market In Old Material

Recent developments in the war situation have added to the general dullness that has characterized this market for the past several weeks. What little transactions have been maintained are more or less of a local nature, to cover the requirements of small consumers. Heavy trading has been virtually eliminated and under the present unsettled state dealers are not anxious to stock up their yards with a lot of material. With munitions operations entirely controlled by the War Trade Boards the business of the small dealers is confined to a relatively small area. Current quotations are unchanged, but are more nominal than actual.

POINTS IN WEEK'S MARKETING NOTES

Pittsburg reports that steel mills and blast furnaces are being seriously interfered with by the spread of Spanish influenza.

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Scrap metal dealers state that there are many more sellers than buyers in the market at present, and from this they look for lower prices in the near future.

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A party of French experts visited Canadian shell shops this week. They stated that the shops of the Dominion were the best they had seen from the standpoint of production and efficiency.

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Large orders of machine tool supplies were shipped this week for the use of the Canadian Siberian expeditionary force. They were sent to Vancouver, where all the material is being assembled.

—

U. S. War Department sent telegrams to operatives not down with influenza to redouble their efforts to keep up the production of machine tools for the fitting out of the war plants.

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Makers of lawn mowers can operate on a forty per cent. basis up to January 1 next, after which time they are expected to go on war work on a 100 per cent. basis.

—

Some war contracts were cancelled in the United States by the government, but this does not indicate any let-up in their plans. The cancellations were made simply because the deliveries could not be made on schedule time, or anything approaching it.

HARDER THAN EVER TO SECURE MATERIAL

Jobbers Not Certain How The New Regulations Are Going To Work Out

TORONTO.—Victory Loan has right of way this week. It's talked of more than the war, more than production, more than machine tools and more than all of them put together. It's surely the cock of the walk for the time being, and any little attention that such common things as trade affairs happen to secure is simply as a word thrown in edgeways.

Machine tool dealers are doing a satisfactory business. There is still talk of 155-m.m. plants, although were they started now it would mean, that with the very best luck and management, they could not produce shells before March or April of next year.

The tendency seems to be to bring the plants already operating to a greater degree of efficiency rather than to start new ones on the road. It is not such a difficult matter to do this, as dealers can supply odd machines for very quick delivery, where the extensive equipment that goes into a new shop takes many months to secure and bring to the point of operation.

For the present the 155-m.m. work seems to hold the greatest interest, and the chances seem to be that this will continue to be the greatest centre of production in Canada for some time yet.

In Smaller Compass

It can be correctly stated that the steel trade looks now for more action in regard to the output of steel, not only in the shape of plates and sheets, but in everything else that has steel in it. Jobbers are not quite certain how they are going to come out in the scramble, but they are quite certain of one thing, and that is that there is apparently no let up in the way that orders are being turned down by the War Trade Board at Ottawa. Formerly it was possible to get material in under ⅛ of an inch in thickness, as this was not on the embargo list. It has been the custom of the trade, and of the government as well to advise users who have been calling for No. 10 gauge to substitute comething lighter, In many cases this has been done. But now the "something lighter" is included in the list of things that have to be passed under the embargo, and the trade is wondering just where they are going to come in under the new order of things. The opinion is also expressed that much of the later movement is due to a desire to straighten out the rather intricate system that has been worked out, by the use of licenses and priorities as well. Just this week war business of a very positive nature was turned down for a firm that is forging for the American government, and the material—plates in this instance—was urgently needed. The usual advice of using something lighter was given, but the trouble is going to be the securing of the something lighter. The jobber who secured the order was so sure that it would be passed at Ottawa that he would, had there been the urgency in the case, have shipped the material along, taking a chance on the War Board sanctioning the release of the material from the warehouse. As a matter of fact applications are getting turned down right and left at Ottawa at present.

A Dull Scrap Market

"We can't say that we are in for an era of lower prices, but there are many things pointing that way," stated one of the large dealers this morning. "The trouble is just now," he continued, "that every person wants to sell their stock, and very few people want to buy in quantities that will make a dent in the large reserves that are being stacked up in almost every place. The result of such a situation is almost invariably that the prices will be forced down, although we cannot say it has come to that yet. Quotations have not come down, but the chances are that they will before long."

There are quite a number of deals put through in which the dealers have no share, and the material passes directly from the sellers to the melters.

The Machine Tool Trade

The month just closed has been a good one for the machine tool trade and for the supply departments as well. The 155-m.m. work accounts for the most of the demand. There is quite a bit of replacement and addition business coming in, and this can be handled to much greater advantage than the putting in of new plants. Dealers have stocks from which they can draw for odd pieces and give good delivery.

Dealers in supplies, especially of high speed goods, report that there is a tendency to buy pretty close to actual needs. The peace talk that was rampant some weeks ago made the producers of shells a little anxious lest some of the cancellation provisions should come into operation. As a result the shops are not very well stocked with this class of material, and when orders do come in they are wanted at once.

Equipment for the Siberian expedition has been furnished by a number of Toronto dealers. A large consignment of reamers, cutters, taps and drills went to the shipping point, Vancouver, this week.

Dealers report that deliveries are very indifferent now for cutters, etc. In fact nearly all the war material supplies have deliveries now that hardly improve on eight or ten weeks, which is a much poorer showing than has been made during the last few months.

PURCHASES SMALL, BUT LOTS OF THEM

Things Holding Up War Orders Are Being Ironed Out Rapidly in United States

Special to CANADIAN MACHINERY

NEW YORK, Oct. 31.—The influenza epidemic has invaded the shops of the manufacturers of machine tools as well as those of the steel plants. Production of machinery has been curtailed because of the disease. How serious is the situation may be judged from the action of the Ordnance Department in sending out telegrams to plants engaged in war work requesting operatives remaining at their tasks to redouble efforts to keep production up to the point reached before the epidemic.

Greater activity in the buying of machine tools was evident in the local market last week but most of the purchases were of relatively small lots of tools. Contracts for equipment to be installed in eastern plants to make shells and pistols are still held in abeyance, but the Lower House at Washington has finally passed the "first deficiency appropriation Bill," setting aside nearly $6,400,000,000 for war expenses. Of this total nearly $3,700,000,000 will be available to the Ordnance Department, and as soon as these funds and credits are available, large contracts for machinery will be closed.

The greatest activity in machinery buying continues to be centered in the central West, especially at Detroit, Cleveland and Chicago. The American Multigraph Co., which recently acquired the Cleveland service plant of the Ford Motor Co to manufacture time fuses for shells, is now buying shop equipment; about 300 tools will be purchased, including 100 automatic screw machines, 100 drilling machines, 50 hand screw machines, and complete tool room equipment. Many other plants in the Central West engaged largely on government work have bought and are still buying shop equipment. The Studebaker Corporation has bought turret lathes and screw machines, and is now negotiating for milling machines. There is a very heavy demand for screw machines from other sources, and 90 have been purchased, mainly by plants in the Central West, including 12 bought by the Willys-Morrow Co., Elmyra, 17 by the Steel Products Co. of Cleveland, 45 by the National Acme Co., Cleveland, and 15 by the Thomas A. Edison Co, Inc., Orange, N.J. The American Brake Shoe and Foundry Co. has purchased 16 turret lathes for its Erie, Pa., plant.

The Olds Motor Works, Lansing, Mich., will devote its entire plant to making aircraft and Liberty motors. Extensions and equipment for this plant will cost $1,250,000. The Symington-Chicago Corp., which is building a large plant to manufacture shells is in the market for tool-room equipment, including lathes, milling machines and drill presses. The Holt Manufacturing Co., which is building an extension to its Peoria, Ill., plant to manufacture caterpillar tractors and tanks, is now buying machinery.

Canadian Buyers

Canadian manufacturers who have large United States government orders are buying very little machinery in this country because under present regulations Dominion buyers may import from the United States only such tools as are unobtainable in Canada. Recent purchases in Canada include boring machines, lathes and hand grooving machines.

Shipyards and railroads are placing supplementary orders for machine tools. W. H. Gahagan Inc., Arverne, Long Island, which is to build steel tugs for the Emergency Fleet Corp., has been buying punches, drills and bending machinery for its new plant and is still in the market for portable shipyard tools. The Robert Dollar Co, N.Y., agent for the Chinese government, is buying 25 machines for rounding out shop equipment of the Shanghai Navy Yard, which will construct four 10,000-ton ships for the United States Emergency Fleet Corp. The Sun Shipbuilding Co. has purchased cranes for its Chester, Pa., plant. The Pennsylvania R. R. has taken bids on cranes for its Altoona shops and is still in the market. The Delaware and Lackawanna Western R. R. is buying a dozen miscellaneous tools for its various repair shops.

STEEL MILLS AND THE BLAST FURNACES HIT HARD BY "FLU"

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Oct. 30.—The epidemic of "Spanish influenza," or "flu' for short, is rather general throughout the east and the central west. The spread seems to depend upon climatic conditions, whereby it has not extended north beyond certain latitudes. The epidemic seems to follow main arteries of travel very largely, and to be severe in accordance with the density of population. Some health authorities have estimated that in the end 15 per cent. of the population will have been affected. As a result of these vagaries of travel some of the steel mills and blast furnaces have been very seriously affected as to their working forces, while others have escaped wholly or largely, and no general average can be struck. As an extreme case the Duquesne Steel Works of the Carnegie Steel Company may be cited, where of late an average of 15 per cent. of the working force of about 5,100 men have been off duty, absence being attributable in nearly all cases to the "flu," but managers feel that there is a disposition to attribute to the "flu" absences that may be due to some other cause, while furthermore some of the absences are due to sickness in the family, rather than to the workman himself. The next most serious case is that of the Homestead Steel Works proper, employing about 8,000 men, and with an average of fully 800 absent. Subsidiary plants, somewhat removed from the main plant, like the Shoen steel wheel department, the Howard Axle Works, etc., are much less affected. In the Shenango valley the epidemic has scarcely been felt, but the Mahoning valley has had some serious experiences.

Altogether the curtailment in production has been much less, in percentage, than the curtailment in working forces. The remaining men seem to work harder. October was expected to show a materially better production rate than the very favorable September showing, in both pig iron and steel ingots, and a rough estimate is that with the curtailment due to the epidemic there will still be shown some slight increase in the rate of production, after allowance has been made for the fact that the month contains one more working day than September, in the case of blast furnaces, and two more in the case of steel works.

Reflected Priority

The War Industries Board seems to have regarded its circular No. 4, dated July 1, but not actually circulated until late in the month, as susceptible of clear and exact interpretation, but it has developed that many, if not the majority, of manufacturers concerned have misinterpreted certain provisions, and it has been necessary to issue precise interpretations, which will materially alter the manner of securing priorities in a great many cases.

The circular provided "automatic priority" for material for a great many war contracts and activities, including, for instance, the following: Turbines, locomotive construction and repair, Fleet Corporation vessels, cranes, farm implements, etc. For these various cases "automatic priority," was prescribed, whereby the buyer, instead of securing an individual priority certificate from the War Industries Board for material, etc., desired, could place his order with merely an endorsement, by affidavit, showing that the material was for the designated purpose, and stating the prescribed priority for the activity, such priorities ranging from A-4 down to B-2.

Many interests interpreted this to mean that the priority would work all along the chain or line, in case material passed through successive hands, for instance, a shipyard could place an order with "automatic priority," and the manufacturer receiving the order could in turn order supplies, to be used in filling the order, with "automatic priority," and the second manufacturer could in turn use the "automatic priority," and son on indefinitely, as long as the identity of the material could be preserved. Such practice accordingly came to prevail in many cases.

Maurice Hirsh, secretary of the Priorities Division of the board, has lately issued a series of rulings cutting all this out. The automatic priority must work but once. The shipyard working for the Fleet Corporation, for instance, may order bolts or rivets with A-5 priority, but the bolt or rivet maker cannot order steel for his goods with an automatic priority. He must secure a priority certificate for the material direct from the Priorities Division, just as would have been necessary before the system of automatic priority was established. The bolt and rivet makers, to continue using them as an illustration, were not named as being accorded any automatic priority. Then there is another clas of cases in which the manufacturer with whom the order is placed has been accorded an automatic priority of his own. Crane building, for instance, is given B-1 priority. Thus the shipyard can order a crane as A-5, and require the crane builder to furnish the crane before he fills other orders that have lower priority or none. The crane builder can place orders for material attaching B-1 priority thereto, and he gets this same priority on all his material, irrespective of which crane order the material is used for filling.

Some of the steel mills appear to be considerably exercised over the new rulings, aserting that there will be a multiplication of small orders upon the mills, from various manufacturers who must secure individual priorities instead of lumping their orders for steel, but the War Industries Board insists that the priorities will be granted promptly, and even states that some cases may be arranged whereby priorities will be granted to cover a succession of individual orders.

More Steel Conservation

Announcements have been made of many additional agreements made between the War Industries Board and manufacturing consumers of iron and steel, whereby the operations of manufacturing consumers will be curtailed more or less. Making lawn mowers is restricted to a 40 per cent. rate to January 1, and the manufacturers are then expected to stop entirely and get into war work. The making of phonograph needles on the other hand is merely restricted to the 1917 rate. Thus there is recognition of the fact that an old lawn mower can be used over again while an old phonograph needle should not be. These agreements are altogether too numerous to summarize. Only in quite exceptional cases is there any intimation that when the restriction has been put into effect provision will be made for furnishing the steel.

Shipbuilding Activities

Recent developments in the matter of shipbuilding should not be interpreted as suggesting that there will be any decrease in the pressure to secure more ships. A batch of contracts for wooden vessels was recently cancelled, but simply because the yards were evidently unable to carry them out in reasonable time. An order for steel for a shipyard extension has been cancelled, likewise an order for steel for building a boiler plant, but these developments simply indicate that existing facilities, or facilities nearing completion, are regarded as sufficient to utilize the labor and materials available. The September completions of vessels for the Fleet Corporation amounted to 360,000 tons deadweight, a new high record, all being from United States yards except one 6,000 ton vessel built in Japan under contract. British shipyards completed over 240,000 tons deadweight in the month, making over 600,000 tons for Britain and the United States, plus the one Japanese vessel for American account. Japan also built other vessels no doubt, and Canadian building is not included.

CANADIAN SHELL SHOPS ARE BEST

That Is The Opinion of French Mechanics Who Are On Tour of District

A party of French mechanics, under the supervision of an interpreter from the Dominion government at Ottawa, has been paying a visit to some of the shell plants in Toronto during the week. The party has been in United States for some months past, going there at the request of the French government in connection with shell work. On Monday morning they were at the plant of the Russell Motor Co., where large orders for the 9.2 shells are being filled. Through their interpreter they expressed their surprise and satisfaction at the splendid results that were being secured in the Canadian plants, intimating in no uncertain way that in their opinion the Dominion of Canada shops were the last word in the speedy and accurate production of munitions.

FIRST STEEL VESSEL LAUNCHED AT MIDLAND

Successful Event Marks Progress of Industry of First Importance.

Midland — The ocean-going cargo steamer "War Fiend," of full canal size, of the modern type, was successfully launched from the shipyards of the Midland Shipbuilding Company, in the presence of a holiday multitude numbering several thousand people.

This was the first launching of the company, and incidentally the first steel vessel to be constructed in Midland, which at present is in the throes of the Spanish "flu" epidemic. Contrary to expectations, the big hulk refused to budge when the ropes were cut, the substructure of the ways having sunken into the ground during theh period the boat was being adjusted on the ways preparatory to making her initial plunge. The launching was set for 1 o'clock, but it was 3.40 before the hull started on its downward path, and in a few seconds it was all over.

The "War Fiend," built to the order of the Imperial Munitions Board for the British Government, is 261 feet long, with a beam 43 feet 6 inches, and a moulded depth of 23 feet. She is equipped with triple expansion engines, surface condensing type, developing 1,250 horse-power. She has two Scotch boilers of the marine type, and is fitted for ocean service with electric plant, cargo winches, steam windlasses, steam and hand steering gears, evaporating outfits, etc.

COMMERCIAL BUSINESS BOBS UP AS SOON AS PEACE TALK STARTS

FROM all reports that can be gathered from the large producing points in the U. S. it is certain that the only let-up in the production of iron there during the past week has been on account of the epidemic of influenza rather than from any peace talk. At the same time there are indications on the surface that the peace talk is having its effect in some places. For instance a clause has just been inserted in new ship steel contracts, which provides for the cancellation of the order by the shipping board whenever it is to the country's interest to do so. Another rather interesting feature is that as soon as there appeared to be some possibility of war work falling off, there immediately came a great grist of enquiries from many lines of commercial work that had been neglected during the course of the war. Conditions at some of the producing points in the U. S. are indicated in the following reports:

CLEVELAND. — Interest is being created here in the placing of contracts for semi-steel shells, and large allocations of war material are being made to shops that will handle these contracts. Pig iron production generally is reported by the furnace interests in this district to be considerably ahead of the record breaking rate of September.

NEW YORK.—It looks as though the war shops were going to be in favor after the war with the producers of iron just as much as they are now. The number of contracts that are being placed here now for 1919 are plainly giving favors to those shops that are certain to have good business prospects in the trade after the war work is over.

PITTSBURGH.—There is a move being made here to the end that the War Industries Board or some such organization should be continued for some period at the expiration of the war order business. Both the consumers and producers of material seem to feel that they will need some court of resort in order to secure fair prices either for buying or selling.

BUFFALO.—A questionnaire has been sent out by the Government to holders of pig iron in this country, and it is quite searching in its provisions—one of the results is that it is quite certain that a number of the users of pig iron had over-estimated the amount that they would require, doing this in order to make sure that their deliveries would be up to the needs of their shops. These figures are being promptly cut down and a good deal of material is being released in this way.

CHICAGO.—Some of the 1919 contracts that are being filled out here at the present time have a number of clauses in them which seek to protect both ends of the trade For instance it is provided that if the Government cease to fix maximum prices at any time, the last maximum price is to be paid for the remainder of iron shipped on the contract. The buyer is given the privilege of cancelling at any time the price is not satisfactory, and the seller reserves the right to cancel if the price fixed is below the cost of production.

ST. LOUIS.—Most of the makers of pig iron in this district have classifications of essentials that will take their output for some time to come. One effect of the peace rumor though has been to stimulate enquiries from the non-essential consumers. It has been brought out very forcibly that there is enormous amount of late business waiting to be executed the moment iron is released to go into it. Building which has virtually been at a standstill for many months is expected to revive the moment materials are available.

THE STORY OF A POUND OF COAL

(Continued from page 516)

of 1 pound of pure water 1 degree Fahrenheit, at or near its maximum density, 39.1 degrees Fahrenheit. One B. T. U. is also equivalent to 778 foot pounds of energy; or 1 B. T. U. per hour = .000293 kilowatt-hour, also 1000 B. T. U. per hour = .293 K.W. hour). Having this quantity in mind the per cent. loss in each apparatus is readily judged as we progress from right to left or reference to the following table prepared by Mr. Scott gives these percentages directly.

Thus we see where the energy in the pound of coal goes to before it finally reaches the switch-board bus-bars. In other words, starting with 100 per cent of energy in the coal when placed in the fire-box, we eventually throw away nearly 90 per cent. of this energy, or to be exact 89.7 per cent., and deliver to the electrical system only 10.3 per cent. of the power we started with, when we lighted the fire in the boiler.

If we operate electric motors from this electrical energy we fare quite well, as the motor has an efficiency of from 80 to 90 per cent. or more, depending upon the size. That is, the motor converts say 90 per cent. of the electrical energy put into it into mechanical power at the pulley. But in converting the electrical energy into radiant light we find that the most efficient of all incandescent filament lamps—the tungsten lamp—only realizes about 5 per cent. efficiency, and requires about 1 watt per candle-power. Thus of the electrical energy put into the lamps we only receive five per cent. in the form of radiant light,—the other 95 per cent. is lost. Lost, all because we of to-day do not know enough to more efficiently convert electric current into radiant light. At the present energy consumption of 1 watt per C. P. for a tungsten lamp and figuring on the perfect transformation of the energy in one pound of coal, viz., 14,150 B. T. U. we would get (14.15 x .293 kilowatt-hour = 4.14 K.W. hr.) 4,145 candle-power, as represented by the large lamp at the right of the illustration. As a matter of fact we only manage to get 1.45 x .293 K.W. hr. or .424 kilowatt-hour, owing to the nearly 90 per cent. loss in the steam-electric generating system. This results in 424 candle-power, as represented by the small tungsten lamp at the left of the illustration, based on 1 watt per candle-power.

The over-all efficiency of the entire system, from coal burned to radiant light is thus seen to be 10.3 per cent. multiplied by 5 per cent. or .51 of 1 per cent.; or a little over one-half of 1 per cent.! Think of it! All we get out of the coal, no matter how much we burn, is a paltry one-half of one per cent. One immediate remedy for this wasteful system of utilizing coal as a source of energy is the mouth-of-mine plant. These electric generating stations, placed at the mines, eliminate all carting and hauling of coal and permit the high tension electric current produced to be transmitted hundreds of miles at very high efficiency.

ANALYSIS OF AVERAGE LOSSES IN CONVERSION OF ONE POUND OF COAL INTO ELECTRICITY

No.	Part of Plant.	B.T.U.	Per cent.	B.T.U.	Per cent.
1.	B. T. U. per lb. coal supplied	14,150	100.00		
2.	Loss in ashes			340	2.4
3.	Loss to stack			3,212	22.7
4.	Loss in boiler radiation and leakage.			1,181	8.0
5.	Returned by feed-water heater	441	3.1		
6.	Returned by economizer	960	6.8		
7.	Loss in pipe radiation			28	0.2
8.	DeDlivered to circulator			223	1.6
9.	Delivered to feed-pump			203	1.4
10.	Loss in leakage and high pressure drips			152	1.1
11.	Delivered to small auxiliaries.......			51	0.4
12.	Heating			31	0.2
13.	Loss in engine friction			111	0.8
14.	Electrical losses			36	0.3
15.	Engine radiation losses			28	0.2
16.	Rejected to condenser			8,524	60.1
17.	To house auxiliaries			29	0.2
		15,551	109.9	14,099	99.6 total loss
		14,099	99.6		
	Delivered to bus-bar	1,452	10.3 gross-efficiency		

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	$32 75	
Lake Superior, charcoal, Chicago	37 50	
Standard low phos., Philadelphia	.....	
Bessemer, Pittsburgh	37 25	
Basic, Valley furnace	33 40	
Government prices.	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 31 00	$ 29 50
Electro copper	31 00	29 50
Castings, copper	30 50	28 50
Tin	90 00	95 00
Spelter	10 50	11 00
Lead	10 50	10 00
Antimony	15 00	18 00
Aluminum	46 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 37

	Black	Galvanized
Standard Buttweld	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15.56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19
Standard Lapweld		
2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%.
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	30 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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.	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅝ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod.	0 38
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 44
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18¼
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	...
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

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THE LAPPING BENCH

Making Thread Gauges

By T. H. FENNER
Associate Editor

IN the manufacture of shells, it is important that extreme accuracy be maintained in all fitted parts and particularly where screw threads are concerned. The making of thread gauges is therefore, a job that calls for the highest amount of precision, all sharp edges are honed off, and ehe gauge may pass the rigid tests called for by the various governments using them. It is pleasing to be able to state that in this highly specialized work, Canada is taking a worthy share, and Canadian firms are making gauges for the Imperial Munitions Board. The Reliance Tool & Motor Co., of Toronto, have been highly successful in this line of work, and a description of their plant and methods will be found of great interest to any one connected with the munition industry, and to toolmakers and machinises, generally. The types of gauges handled by this company include the Marks II Fuse-U.S. 155 m.m. and 75 m.m. adapter, 155 m.m. and 240 m.m. shell, and Booster Casing Mark III thread gauges.

The List of Operations

In making the ring gauge quite a number of operations are necessary, seventeen in all. They are arranged as follows:—

1.—Cut off stock in Power Saw.

2.—Rough Bore Hole.

3.—Put on Arbor, and take cut off dia. and sides.

4.—Place Gauge in oil tank at 500 degrees F., and leave 12 hours.

5.—Anneal.

6.—Finish bore hole and face one side.

7.—Finish face both sides, and rough thread within 1-32 inch of original dia.

8.—Carbonize and have soft.

9.—Finish thread and face to width.

10.—Cut slot in gauge.

11.—Harden.

12.—Rough grind to within .005 of size and allow to stand 48 hours.

13.—Final rough grind on finisher and have stand 24 hours.

14.—Finish grind to size.

15.—Grind root diameter and face. Have all sharp edges of gauge.

16.—Check.

17.—Marking.

The operations for making the internal gauge are somewhat different, so for instance, instead of operation 2 being rough boring hole, as in the ring gauge, it would be rough turn. After rough turning the heat treatment takes place, following which comes the first thread cutting. Here we find something novel in the manner this is carried out.

Cutting The Thread

The tool used for this operation is a Le Blond heavy duty lathe, fitted with a precision lead screw. It will be noticed from the illustration that the tool is in the inverse position to that usually found in turning operations. That is to say, that instead of the cutting edge of the tool being on the top, and the job turning towards the operator, the tool is placed with the cutting edge down, and the job turning away from the operator. This method has been adopted as leading to best results in the class of work done. In cutting a thread in the ordinary way, with the very fine clearances used in the tools, it was found that small chips were apt to collect on the top of the tool, and the motion of the job would carry them down between the tool and the thread, making a ragged thread, and in some cases breaking a piece out, the result being a scrapped gauge. By turning the lathe backwards, and turning the tool upside down, the chips all drop clear, and it is also found that all tendency to chatter is eliminated. The error in the lead screw in these lathes is about .0004 in 5 inches, so that in the length of the thread that is cut, about 5/8 inch, the error is not perceptible.

CUTTING THE THREAD ON CHECK GAUGE

The Heat Treatment

The heat treatment between the operations of rough boring or turning, and the finish boring or thread cutting consists of a 12 hour soak in the tank containing oil at 500 degrees F. After coming out of the oil bath, the gauges are put in a pot, placed in a furnace, and brought slowly up to a temperature of 1320 degrees F., after which they are allowed to cool down to atmospheric temperature before removing from the box.

Finish Boring Operations

The finish boring operation is performed on Le Blond engine lathe, a standard undersized reamer being used. After boring, one side is faced. The gauge is then placed on an arbor and both sides faced in the lathe, after which they are taken off the arbor, and the thread is rough turned to within 1-32 in. of the original diameter. Carbonizing is the next operation, the gauges being left soft. After this the thread is finished in the lathe, and the gauge is faced to the finish width.

Cutting The Slot

The final machine operation to be performed on the ring gauge is the cutting of the slots. There are three of these, as shown in the sketch. The three slots are cut with a very fine saw, and then the hole is drilled and tapped for the adjusting screw. This screw is for the purpose of making adjustment to the amount of the slot opening. After the gauge is finally adjusted, a liner is placed in the slot, and the screw is sealed to prevent tampering. The gauge is then hardened.

Grinding Operations

The first operation after hardening is to rough grind to within .005 of size, after which the gauge is allowed to stand for 48 hours, for seasoning. A final rough grind is then made, and another 24 hours seasoning allowed to interpose, before finish grinding to size on outside. The thread is then ground to root diameter on thread grinding machine. The final operation is marking with size, firm's name, etc. This is done by etching.

FINISH GRINDING THE THREAD

Limits Allowable

The limits allowable in this work are extremely fine. An example of this is shown by the following specification for the United States 32 thread per inch Right Hand Gauge.

Pitch Diameter = 1.480—.0002.

½ Angle=30° plus or minus 20 minutes

Lead=plus or minus .0002 in. in .22 in.

This allows for the pitch diameter only two ten thousandths, and for the lead two ten thousandths either way, or four ten thousandths in all. The allowance in the angle of the thread is 1.1 per cent., so it can be readily understood that extreme care is necessary in each operation.

All lapping operations are performed by hand, and the illustration shows the corner of the shop devoted to the lapping benches.

Some Details of The Work

Another interesting detail shown here is setting the tool for cutting the thread on the plug gauge. The photograph illustrates this very clearly. As can be seen, a clamp is the lathe and a pair of callipers clamped onto this by one leg. On the other leg is clamped a spring indicator, registering in ten thousandth parts of an inch. A stop is placed against the tail stock of the lathe, and the carriage is brought back against the stop by the screw. The tool is then in contact with the indicator, at the cutting end. The carriage is then moved clear of the stop, and the tool holder moved in to the job till the back of the tool is in line with the indicator. The carriage is moved back onto the stop, when the

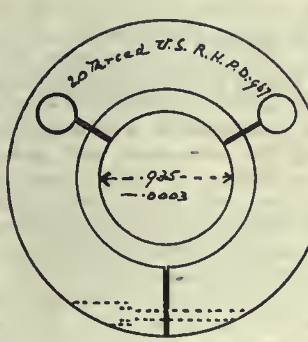
SETTING THE COMPOUND REST

back of the tool will be in contact with the indicator. If the reading is the same in both positions, then there is no doubt of the perfect alignment of the tool, and the thread can be cut without fear of error.

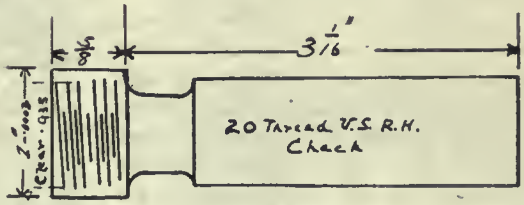
Setting the compound rest of the lathe to get the correct angle for the cutting tool is an interesting job. The illustration makes it perfectly clear. An angle plate is bolted on to the face plate of the lathe. This angle plate is perfectly square being lapped all over. A protractor with an attachment for a straight edge is clamped on to the angle plate, the protractor being marked in degrees and quarters, and a vernier mounted on the protractor reading minutes. A dial indicator is mounted on the tool post, and the spindle of the indicator brought in contact with the straight edge. By moving the rest in and out along the straightedge, and watching the indicator, any error over .0001 of an inch can be detected.

A Good Word For the I. M. B.

The Reliance Tool and Motor Co. had been making and shipping gauges to the U. S. before handling any Canadian business. On the suggestion of the War Trade Board that Canadian business should be looked after before exporting the firm got in touch with the Imperial Munitions Board, and received enough orders to fully occupy them without looking any further afield. In this connection they received very valuable help from the inspection department, headed by Capt. Durley of the Imperial Ordnance Dept. at Ottawa. While it is, for well understood reasons, impossible to go into details, it may be said that it was always possible to get the ungrudging help of Capt. Durley and his staff when any information was required that it was in their power to furnish, and this without any expense to the company. While we



RING GAUGE



CHECK

often hear complaints of red tape, etc., in connection with government work, it is pleasant to hear the expressions of appreciation from a firm engaged in such difficult work, for assistance and advice so heartily given.

The Personal Factor

The man who has built up this highly successful business is Mr. Thos. L. May, of Toronto. Mr. May is a thoroughly practical man. He started his career as an apprentice to the Bertram Engine Works, Toronto, building engines, in 1896. He remained with them until 1900, when he went to Niagara Falls, with the Usher Wease Co., of Switzerland, where he was engaged on the installation of the first Hydro electric power stations. He remained with them about three years, and incidentally, first came in touch with the metric system. From there he went to the Waterbury File and Machine Co., where for two years he was in their tool making department. On leaving them he came back to Toronto the Toronto Silver Plate, in the tool room, having previously taken a correspondence course in mathematics. He later took charge of this department. He remained with them for about 3 years, and then started a small jobbing shop in Toronto, at 126 Adelaide Street, where he made the metallic but-

METHOD OF ADJUSTING CUTTING TOOL

tons for the militia uniform tunics, probably the first made in Canada. He then went with the Brandon Shell Co., now defunct, making the 45 shell, and in 1915 started the present company in conjunction with Mr. Geo. S. Brintnell. In March 1916 Mr. Brintnell retired, Mr. May taking over most of his interest, and since then has carried on the business in association with Mr. W. H. Newman, of Rowen Jones & Somerville. For about 1½ years has been making thread gauges, and has achieved a market success, not without much persistent work and worry. Mr. May personally superintends the manufacture of the gauges throughout. In speaking of his success, Mr. May gives great credit to the organization he has gathered about him, for their personal interest and attention to the various operations covered in the making of a highly finished product.

FACE GRINDING PLUG GAUGE

CONVERTING A GROUCH

By J. James

A few days ago an engineer remarked to me, "These engineering journals make me weary." Said I, "What special ailment is bothering you now, my friend?" He elucidated somewhat as follows:

"The editors come at a fellow and call him down because he will not write about how he overcame some difficulty in connection with his work. They say, never mind if your sketch is crude and your letter shy on correct grammar, writing or spelling, we will polish them up for you, it is the idea we want, and we will cash up for that same idea, telling how you won out and so forth and so on. There am I taking their advice and using up my postage stamps, time and stationery to help them out, and every time my letters come back, not because they are not good enough, so reads their printed notice enclosed with the returned letter, but because they are not suitable for the journal. How do I know what will suit them? I send them power plant experiences all right, dang it all, my experiences are just as good as some of those I see in print, and better than a lot of them." At this point he paused, but before he got started on the second lap I cut in. "Will you allow me to throw some talk for awhile? I have written many hundreds of letters for these journals you talk about and have received cash for many of them; I have also had many of them returned as being unsuitable, perhaps the ideas therein were old and had been printed several times without my knowledge, in fact on two occasions when I thought I had solved some particularly difficult problem the editor made a note directing my attention to where practically the same idea had been printed many moons before I had sent in my MSS.

"Another way to look at things is this: The editor is the buyer for the publisher; he is paid for what he knows about goods that will give satisfaction to the publishers' customers; these are the subscribers as a whole, he is responsible for the material dished out in the editorial or reading pages. He does not want to tell a customer, who is trying to sell him some stale goods that the said goods are out of date, he just sends on a polite printed note letting him down easy, and perhaps the note contains a carefully hinted suggestion to try and bunco some other editor who may prove an easy mark." At this point I started talking again before my friend could do so.

"Suppose a traveling salesman for some goods of which you had a big stock on hand, called on you and insisted you buy more of the goods just because they were good, the fact that you did not want any more of them making no difference to him, what would you do, would you give in to him and buy something you did not want with your nice handy cash just because he thought he knew your business better than you did yourself?

"Perhaps you are in the same class, trying to sell something the editor has enough of or has had enough of. Try again, perhaps your next near original idea will catch him unprepared, and he may cause your chest to swell and your heart to throb when you receive his check for a whole lot of dollars, perhaps as many as two, but never forget he is the buyer and you the seller. If you cannot think up something original try and put a disguise on it and make it look original (this is my advice, not the editor's. I bet he won't print it), perhaps you may get by with it. An editor is only human—you may not believe this but it is true, so if you stick to it long enough you are bound to get him some day and receive enough coin to pay for all the stamps and stationery you have used up in the past."

"Dang it," said my friend. "I thought I could talk, you are it, take some advice from me, quit engineering, go sell books, you will make a fortune. No one could choke you off. Say, I believe you have done me good, anyhow, I'll think better about those editor fellows, especially do I pity them if they have to watch out for fellows like you if you write as fast as you gas."

SPOT WELDED BRAKE HANGERS

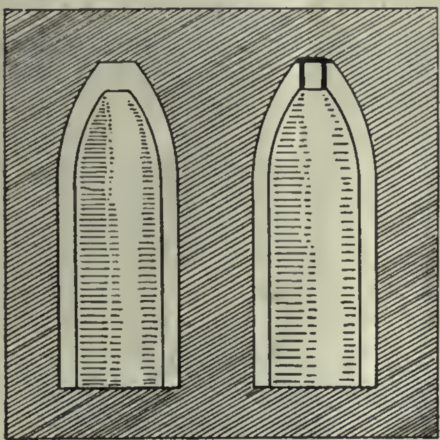
The Portland Railway, Light and Power Co. finds that the half-ball brake hangers used on its Brill trucks can be repaired by spot welding. The repair costs less than a new part (besides eliminating delivery delays), and the repaired parts have longer life than the new equipment. The worn parts are sorted according to their condition and repaired to fit corresponding gauges.—"Electric Railway Journal."

GAS RIVET HEATERS

At the Bethlehem Shipbuilding Corporation's Alameda Works, U.S.A., gas is henceforth to be used exclusively for rivet heating, plate-bending, and general fabricating heating purposes. This is a radical departure from the shipbuilding methods that have been in use for years, whereby it was thought that only coke could be used—even oil was considered an innovation. Good work by a riveting crew depends to a great extent on properly heated rivets. With a continuous and uniform gas forge the heater man can give his undivided attention to regulating the forge so that there will be no burned or overheated rivets, irrespective of the speed at which the crew works. This tends towards regularity, with properly upset and tight, full-headed rivets as a result. The cooling contraction is likewise more uniform, and caulking is reduced to a minimum.—"Chemical and Metallurgical Engineering."

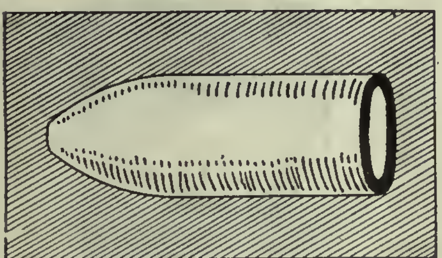
Machining Nine Point Two Shell and Adapter

The Various Machining Operations Are Described and Illustrated in Detail—To Machine the Shell Requires Twenty-four Operations—While to Turn Out the Adapter Nine More Are Necessary



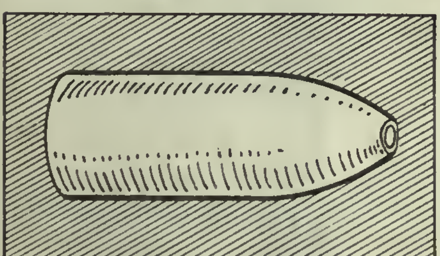
OPERATION NO. 1

DRILL AND ROUGH FACE with drill press and revolving table with expanding mandrels for two shells or radial drill with stationary mandrels.



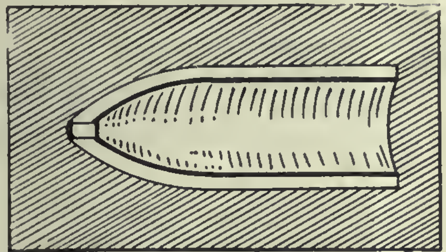
OPERATION NO. 2

CUT OFF OPEN END with special single purpose machine (two tools opposite each other cutting towards the centre.



OPERATION NO. 3

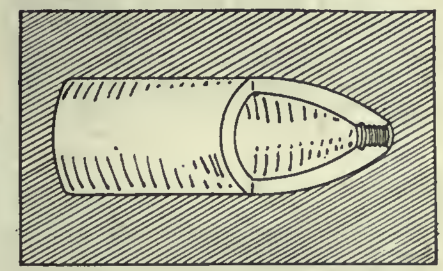
ROUGH TURN OUTSIDE with lathe having one carriage and face cam profiling attachment or with lathe equipped with two carriages one for straight part of shell and the other for the radius. Shell held on expanding mandrel.



OPERATION NO. 4

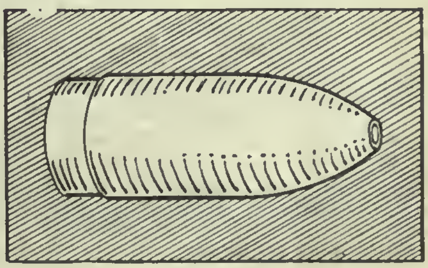
BORE single (internal) radius shells with single pointed tool with face cam profile attachment on boring lathe.

For single or double (internal) radius shells, two cutters for roughing straight part, two profile roughing blades and two profile finishing blades - three separate and interchangable boring heads. The shell is held in a clamp chuck.



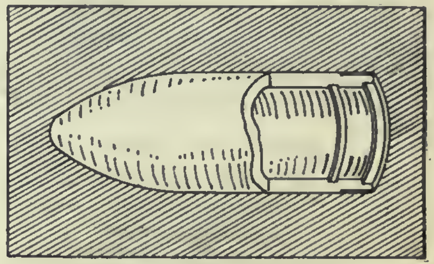
OPERATION NO. 5

FINISH FUZE HOLE with boring recessing, angle facing tools, shell reamer and colapsable tap in turret lathe. Shell held on expanding mandrel.



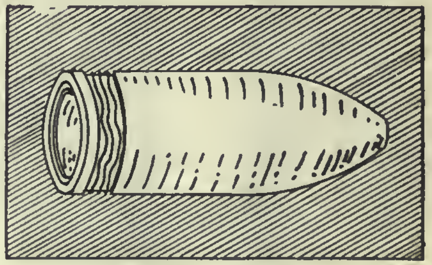
OPERATION NO. 6

FINISH TURN with single pointed tool on lathe with face cam profiling attachment. Shell held on expanding mandrel.



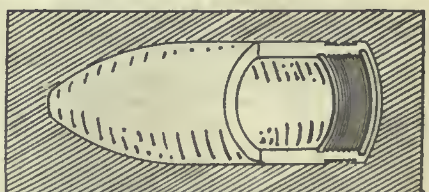
OPERATION NO. 7

COUNTERBORE AND RECESS BASE END with roughing and finishing counterbore tools and recessing tool in turret lathe. Shell held in three jaw floating ring pot chuck and plain three jaw steady at base end.



OPERATION NO. 8

GROOVE AND WAVE, special single purpose machine or lathe with attachment (face cam and etc) for cutting waved ribs with tools for roughing and undercutting. Tools in turret or four way tool post. Shell held on expanding mandrel.



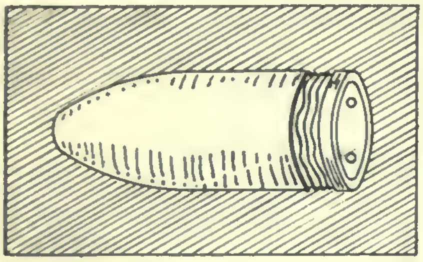
OPERATION NO. 9

THREAD BASE END, shells up to 9.2 and inclusive, colapsable tap on drill press, shell held in hinged clamp chuck.

Or special single purpose thread miller.

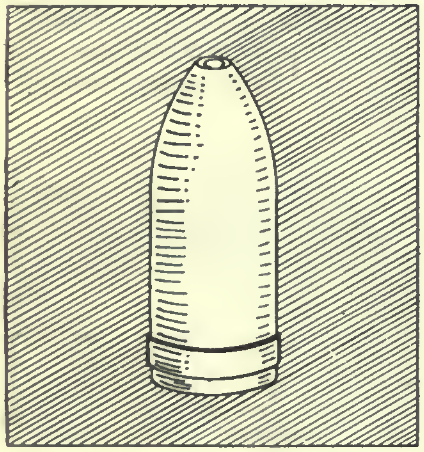
OPERATION NO. 10
PRELIMINARY SHOP INSPECTION

OPERATION NO. 11
PRELIMINARY GOVERNMENT INSPECTION.



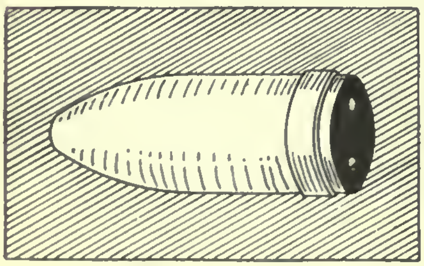
OPERATION NO. 12
FIT ADAPTER by hand.

OPERATION NO. 13
SCREW IN ADAPTER with special power driven screw driver or with hand wrench, shell held in floor clamp.



OPERATION NO. 14
APPLY BAND when hot after annealing in special electric heater or gas furnace. Band applied by special banding press.

OPERATION NO. 15
WEIGH on standard scales.



OPERATION NO. 16
FACE BASE TO WEIGHT with standard turning tool on lathe. Shell driven by centre screwed into nose threads. Shell supported at base end by roller-steady.

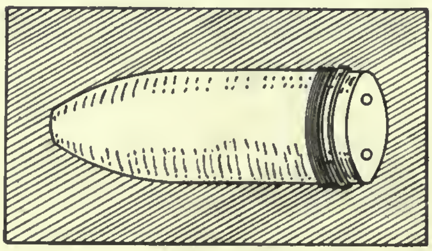
OPERATION NO. 17
CHECK WEIGHT on standard scales.

OPERATION NO. 18
STAMP BASE, with fixture to hold stamps in proper position clamped over base of shell. Hand hammer used for stamping. Shell held (at balancing point) in tilting cradle on bench to facilitate easier use of hammer.

OPERATION NO. 19
WASH AND CLEAN Shells are lowered into a tank of hot water and alkali thoroughly rinsed and then allowed to dry.

OPERATION NO. 20
VARNISH (depending upon specifications). If after adapter has been inserted, a special varnish spraying machine with traveling nozzle and roller cradle for revolving shell or by means of a small varnish spraying gun mounted on a board held in a slide. Shell revolved on belt driven rollers when varnish gun is being slid in and out of shell. Gun is fitted with nozzle to suit depth of bore in shell.

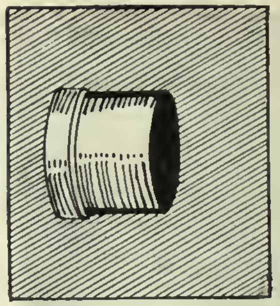
OPERATION NO. 21
BAKE VARNISH (at specified temperature) in special electric heaters or in gas oven in the later case the shells are placed base down on trucks of suitable size and run into oven on a track.



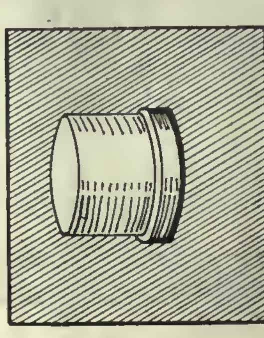
OPERATION NO. 22
TURN COPPER BAND on special single purpose machine or lathe with carriage equipped with special tool holders and tools, two single pointed tools for trimming band to width, rough form turning tool and finish form shaving tool. Shell is held on lathe by expanding mandrel.

OPERATION NO. 23
FINAL SHOP INSPECTION

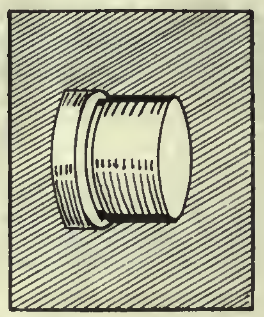
OPERATION NO. 24
FINAL GOVERNMENT INSPECTION.



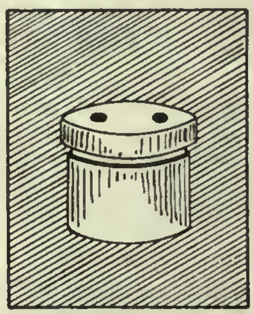
OPERATION NO. 1
ROUGH TURN AND FACE BODY on lathe. The adapter is held by its flange in a three jaw universal chuck.



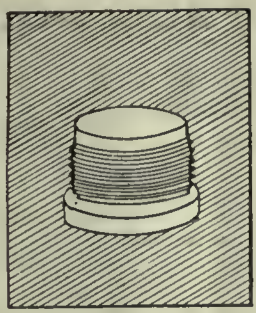
OPERATION NO. 2
ROUGH TURN AND FACE FLANGE on lathe. The adapter is held by its body in a three jaw universal chuck.



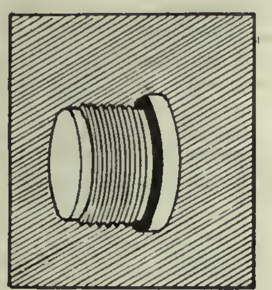
OPERATION NO. 3
FINISH TURN BODY AND RECESS on lathe. The adapter is held by its flange in a three jaw universal chuck.



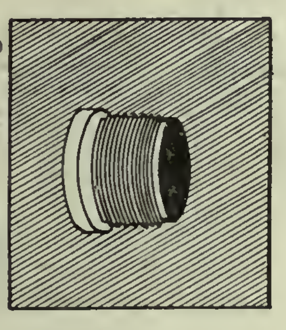
OPERATION NO. 4
DRILL WRENCH HOLES on drill press. The adapter is held by its body in a box (clamp) jig.



OPERATION NO.5
CUT THREADS on drill press with self opening die. The adapter is centered by its flange and held by dowel pins in its wrench holes. If a special thread miller is used for this operation the wrench holes may have to be tapped before this operation to hold adapter in the miller and re-drilled afterwards.



OPERATION NO.6
FINISH TURN AND SQUARE FLANGE on lathe. The adapter is held by its threads in a three jaw (threaded to suit adapter) universal chuck.



OPERATION NO.7
FINISH TURN AND FACE PILOT on lathe. The adapter is held as in the sixth operation but with its pilot outwards.

OPERATION NO.8
FINAL SHOP INSPECTION.

OPERATION NO.9
FINAL GOVERNMENT INSPECTION.

UNUSUAL LUBRICANTS

By M. M.

The problem of lubrication is by no means simple and its complexity has been pointed out on many occasions. Lubrication is conditioned by many circumstances.

A spindle from the machine and likewise the bearing in which it is carried have surfaces which consist of circumferential grooves. These are minute, but until the surface more nearly approaches a perfect cylinder, a new bearing requires unusual care until run in, otherwise until the hills have been abraided to the level of the valleys. It is by no means well known that longititudinal drawfiling with a dead smooth file has, before to-day, restored running conditions in a bearing which would not behave. For large spindles such treatment is beneficial before erection and is seriously recommended. Since it will restore a bearing which persistently runs warm to a sense of due behaviour, it is worth more general adoption.

There are instances where a big job must be kept running at all costs with a hot bearing, and playing a hose on the same may dissipate the heat, but does not remove the conditions; leading as it does to very rapid wear.

There are a few simple prescriptions all of them tried and found successful, which have restored a hot bearing to good running conditions, when shutting down was impossible. Heavy doses of castor oil and minute alterations or injections of distilled water, to induce saponification, is one remedy. Graphite and lubricating oil is another. The worst cases are those in which a steel spindle runs in gun-metal, and there is no remedy to compare with flour of sulphur mired with lubricating oil; it acts like a charm in most instances, and is strongly advised.

Cast iron sliding on cast iron gives in time a surface skin whose co-officient of friction is very small, and such skin is not easily broken. When this surface is abraided, the conditions are rather startling, for actual red hot sparks commence to fly in a very short time, and lubricating oil simply burns to a carbon deposit, and has no effect whatever. Putty white lead, mixed with lubricating oil, has been successfully used to cure even these conditions. The most unusual lubricant which came under personal notice and experience was used in the thrust bearing of a steamer, and han been utilized there for many years. As is well known, the type of bearing has a large enclosed volume which can serve as a bath. This was filled to axis of shaft with a solution of soft soap in distilled water, about 1 cwt. of soft soap sufficing for six month's use. The entire contents were occasionally changed, and a daily feed of about ½ pint of strong solution added. The bearing never gave trouble unless a new greaser started to oil it, when its temperature increased in direct ratio to the amount of oil.

When a bearing gets hot, the metals are in intimate contact, and the normal film is broken down. The remedies noticed restore conditions by the interposition of a more durable film between the surfaces. They give an artificial skin to the bruised surfaces, and allow gradual restoration of its condition.

Unlike the nigger doctor, who gave rosin and alum for a broken limb—the last to draw the bones together, and the first to stick them—the remedies, although perhaps not scientific, are successful. A word of caution is perhaps advisable—don't follow Mark Twain in his cure for a cold, and mix the remedies —give one a chance before trying another.

Finally, the remedies here noticed are known to, and practised by, marine engineers, and they have before to-day, kept the job running when a shut down on a lee shore would have meant disaster. This last for the sceptic who may be inclined to doubt their efficacy.

The Jeffrey Manufacturing Company have issued a catalogue No. 175 on the subject of belt conveyors which will prove of value to the manufacturer, engineer or contractor having to do with the economical handling of materials. A department from the usual catalogue has been made in that the subject of belt conveyors is treated from a strictly engineering standpoint and the purchasers requirements for information regarding capacities speeds, etc., are fully met.

Early types of belt conveyors are treated of as an interesting historical sidelight and the various improvements which followed a desire for better service follow in order. Some idea of the scope of the belt conveyor and of the many industries using it is given in a chapter devoted to the various industries and their use in detail of the belt conveyor.

Little information is available regarding the engineering design of belt conveyors and the portion of this catalogue which gives, condensed data for the engineer, belt tension and horse-power pull, general tables of belt capacities, belting facts in widths, plys and covers is of timely interest and should prove of high value to those having to do with the design of conveyor installations. Other subjects treated of are, protecting the life of the conveyor belt, curve of belt from horizontal to incline, various forms of belt conveyor drives, spacing of conveyor parts for best service, methods of loading and unloading belts and rules for installing conveyors. This catalogue is being issued through the Montreal office of the Jeffrey Manufacturing Co., Power Building, Montreal.

Company Can Build.—The Cluff Ammunition Company, of Toronto, made application for the use of a building at Atlantic avenue for the storing of shells, at the meeting of the Property Commission. It was explained that it would only be used during the war and torn down after the war. The application was granted.

Tooling Up Single Spindle Automatics and Lathes

Tooling For British 101 Fuse Body—Importance of Gauging—Method of Gauging—Planning Sequence of Operations to Enable Limits to be Easily Adhered to—Reducing the Poor Work

THE demand for accurate and rapid production of parts from bar steel has caused an increased need of experienced mechanics as designers, tool setters and head operators.

The particular part referred to in this article is the British 101 fuse body. Fig. 1 shows the first operation and the final tooling that was arrived at and which secured the best result. The operation being carried out on a No. 4 single spindle Gridler automatic. The sequence of this operation is worthy of note, the manner in which the rough and finish forming, and the drilling was accomplished.

The actual gauges necessary to check the work performed in this operation are illustrated in Fig. 2. The gauges were designed along lines that would advance and secure rapid and accurate inspection, as it must be born in mind by the mechanic, that this is most important, first, inasmuch as the gauging is an expensive necessity both from the viewpoint of operation and the gauges themselves, second, that should incorrect work be permitted to pass inspection that owing to a latter check its rejection would mean additional expense in time wasted.

Fig. 2A, shows the fuse body after the first operation, the gauges being used marked across each dimension line.

The second operation that of reaming, drilling and rough facing to length, was carried out on a similar machine and is illustrated by Fig. 3. The method of gauging to determine as to whether or not the piece is within the required limits is shown in Fig. 4.

Fig. 4A shows the fuse body after the second operation, the gauges used being marked on the dimension lines. Gauges R. 112-II. determines the proper length of the core.

The third operation, that of shaving grooving, knurling, recessing and chamfering is illustrated by Fig. 5. It being a good example of the type of work which can be performed on a turret lathe.

Fig. 6 shows the gauges used after this operation. Attention is called to the comparative few number of gauges required, although the operation is not what might be called simple.

Fig. 6A shows the fuse body after this operation, the gauges being marked on same as previously noted in the first and second operations.

The illustrations explaining the various operations can be carried out in similar manner on various components, the principle being identical and in keeping with general practice.

As previously pointed out the method of gauging to be employed must be considered at the offset and laid out to determine a simple and accurate means of securing the required results.

In planning similar operations close limit requirements on certain dimensions must be considered and the sequence of operations so arranged that such dimensions, or rather their limit, can be easily and readily adhered to. The mechanic in charge and responsible for the work of a battery of machines must have or rather will be in a far

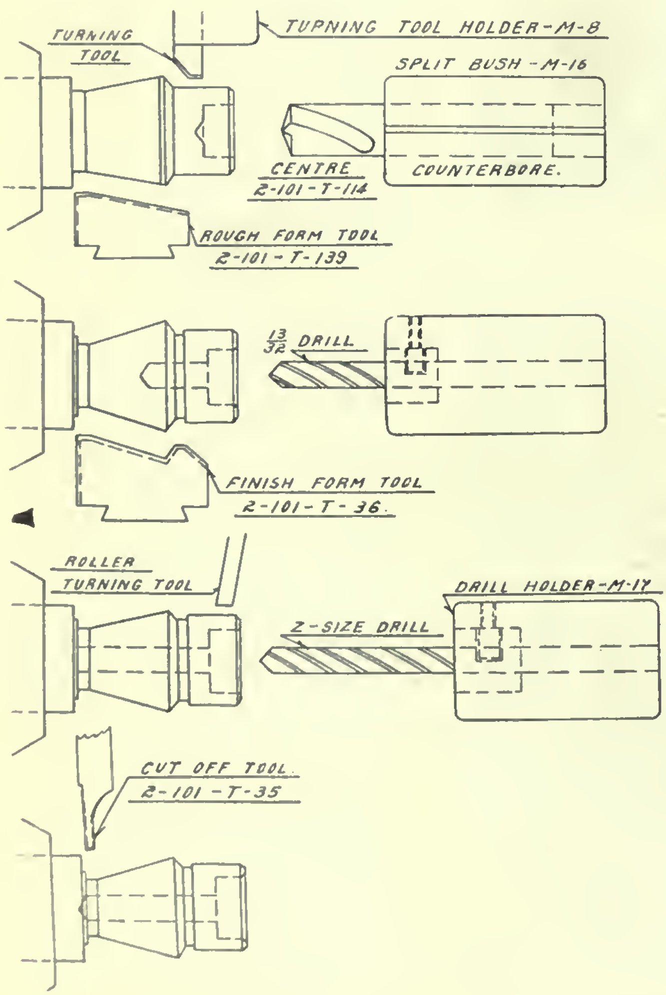


FIG. 1

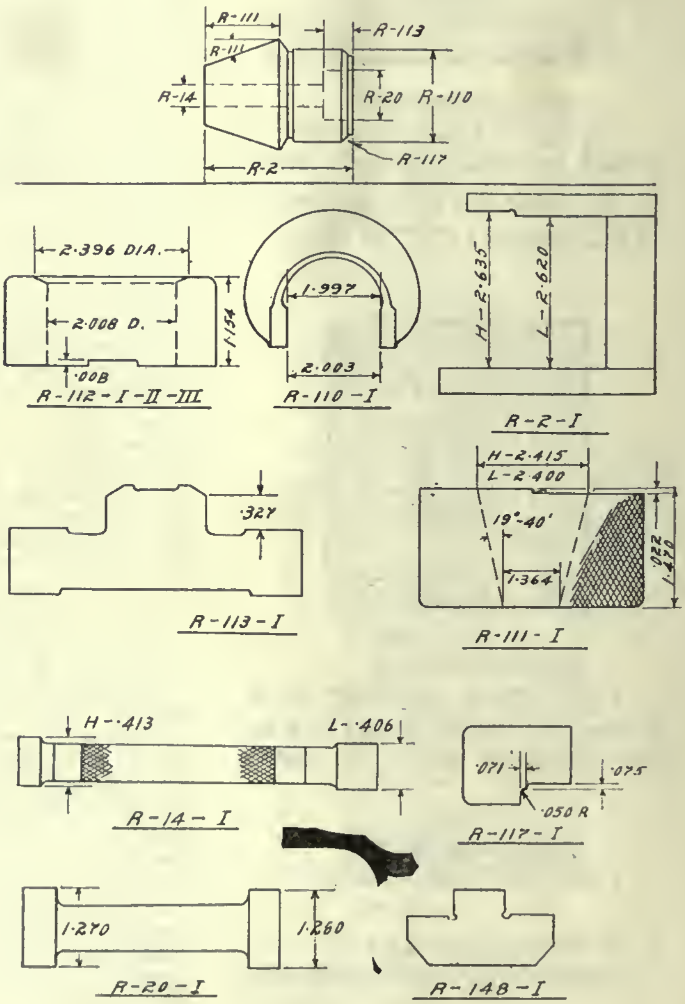


FIG. 2

better position to secure the desired results if he is familiar with the whys and wherefores of the planning of his operation in hand.

In order to reduce the amount of poor, scrap and what is termed salvageable work, a control inspection should be installed. This consists of the gauging directly of each indivdual machine during certain appointed hours or intervals. By such means the poor work can be reduced to a minimum and correctly before any great amount of similar work is produced.

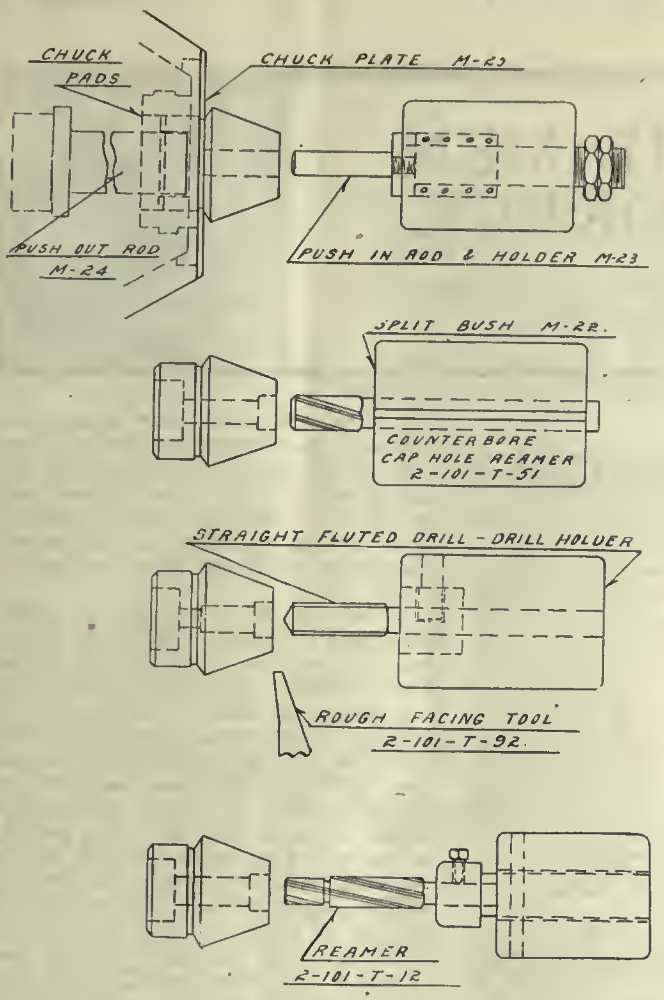
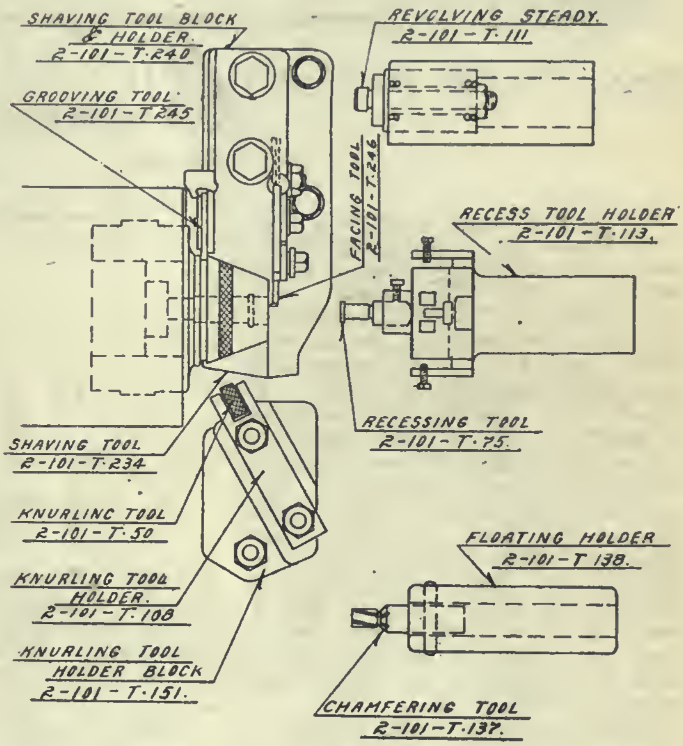


FIG. 3



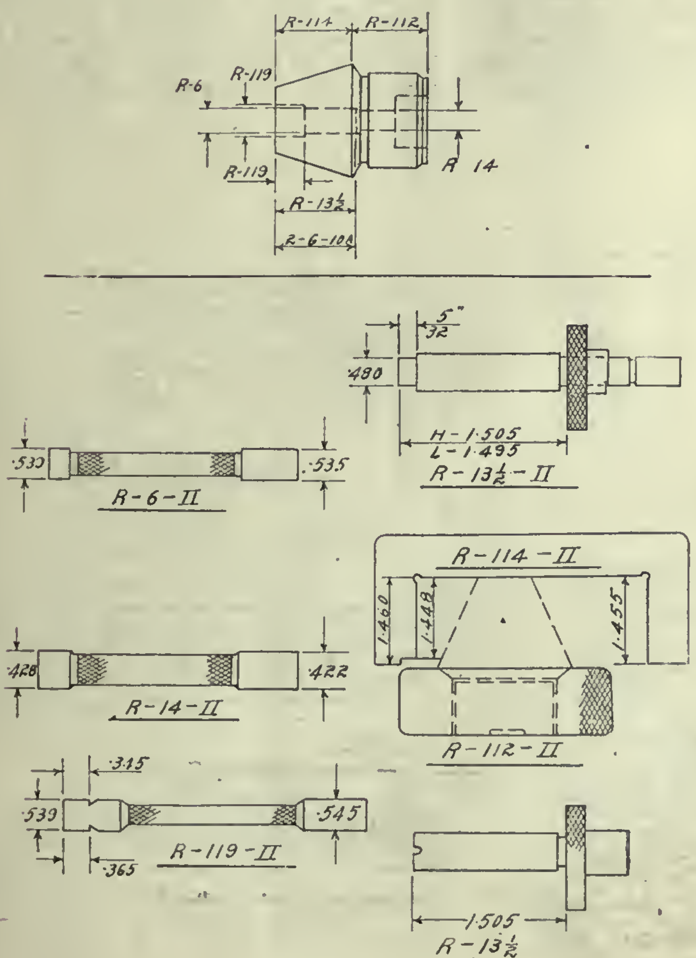


FIG. 4

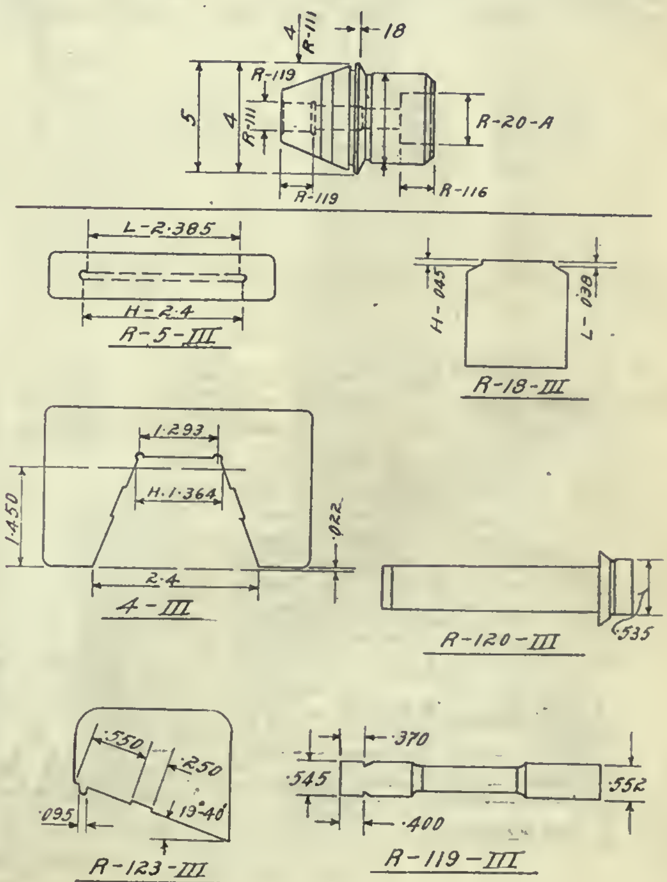


FIG. 6

FROM THE MEN WHO PRODUCE

Methods, Machining Devices, Systems and Suggestions From Shop And Drafting Room

BENDING PUNCH AND DIE FOR MAGAZINE PLATE

By F. SCRIBER

The accompanying ilustrations, Figs. 1 and 2, show an assembly drawing and details respectively for bending up the edge X on the rifle magazine plate shown in Fig. 3. This plate is previously blanked out to shape and has the holes shown punched in it. In this operation it is located on two pins A, Fig. 1, although these pins are not depended on to keep it in position while bending as it is backed up along the edges X and Z, which are opposite the bend by solid metal which conforms to the outline of the magazine plate. This die is of the spring pad type, the spring pad is indicated as C. This spring pad fits in the centre of the die blank D, and the punch E in conjunction with the die block and spring pad are the chief features of this tool and are what actually performs the bend.

Before describing just how this bend is performed it is first advisable to more completely describe the construction of

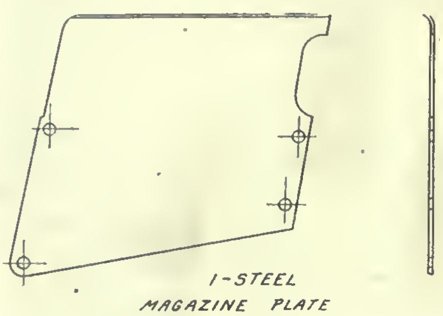


FIG. 3—MAGAZINE PLATE

the die. The punch E is held by screws and dowels to a punch holder F, this punch holder fits into the ram of the punch press. In the punch E two holes G, are drilled, these are clearance holes so they will not interfere with the pins A, while the punch and die are in operation. The die block D, is likewise held to the die holder H, by screws and dowels and in this die block four springs are provided. These springs enter the spring pad and are backed up by screws J. The spring pad is free to slide up and down in the die block it being prevented from coming up more than the desired amount by the flange on the spring pad at K.

In bending this piece the flat magazine plate is placed on top of the spring pad, the top surface of this spring pad being at this time slightly above the top surface of the die. It is located on the pad and is backed up by the solid metal as previously described. As the ram of the punch press descends the magazine plate is firmly jammed between the punch and the spring pad and as the punch continues down it carries the spring pad with it and thus the edge of the magazine plate is curved up by the die as indicated at X in the lower right hand view of Fig. 2. As the ram of the punch press ascends the spring pad carries the magazine plate or work up and the work may thus be easily picked off the top of the die. A slot Z, is cut across the end of the pad so a hook may be used to pick the work off the pad. The parts shown on Fig. 2 are

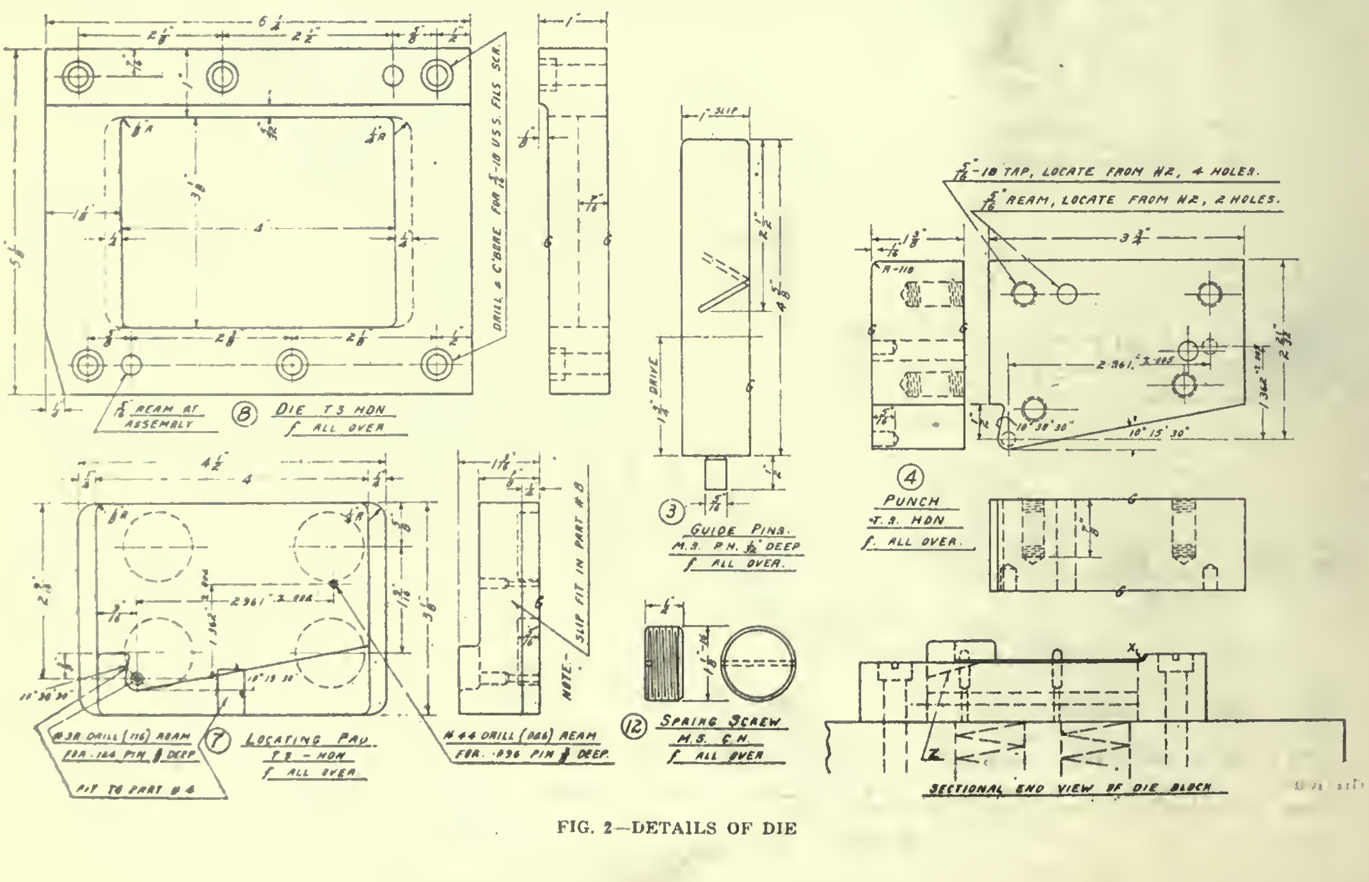


FIG. 2—DETAILS OF DIE

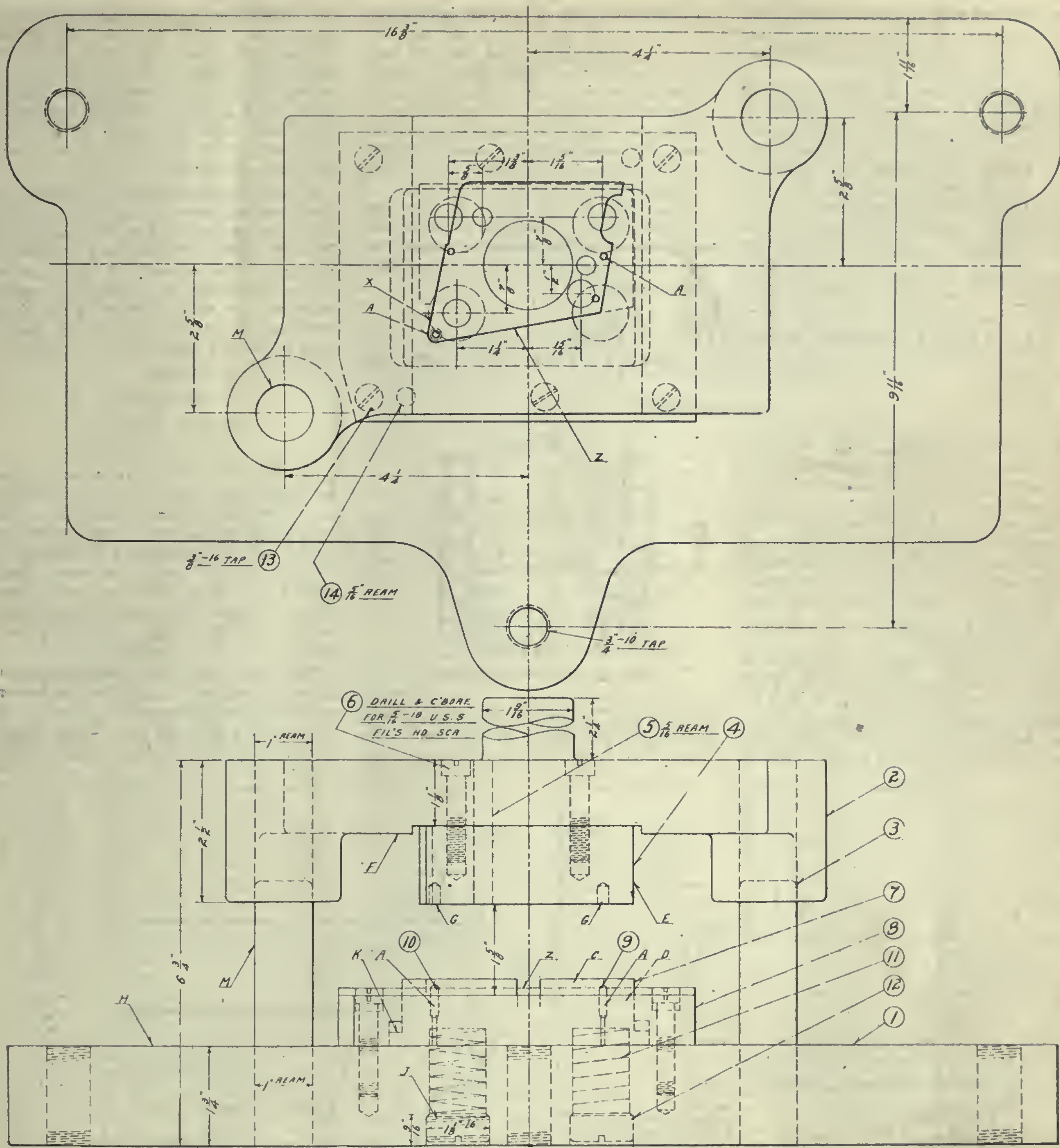


FIG. 1—GENERAL ARRANGEMENT

some of the details of this die each detail shown has a number on it enclosed by a circle and this number corresponds to the same number on the assembly drawing Fig. 1, while in the upper right hand corner of Fig. 2 a list of material is given.

SYMMETRICAL TEMPLETS

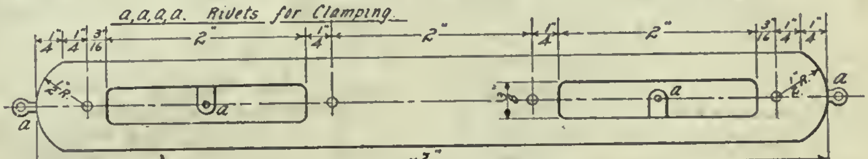
By JOHN ECCLES

The making of a templet, which is symmetrical about a centre line, seems to give many a tool maker considerable difficulty.

From a toolmaker's standpoint the tendency is to work too close to the line before reversing only to find not sufficient stock left to get a clean up.

The trouble usually run into in making only one templet at a time is that errors are never checked as accurately and the finished product does not show the interchangeability it should.

Assuming that we are to make a piece as per illustration, the writer has found the following method most successful. Instead of making one only, choose stock for two and after getting it perfectly flat and doing all lettering, proceed to make the usual lay-out by means of height gauge, (a scale and scratch awl are not accurate enough).



FINISHED TEMPLET

Next, rivet the two pieces together outside of the layout so as not to marr finished piece, placing pins as illustrated to allow for machining.

Machine in shaper or milling machine, leaving about .005 per side outside of line. Next, clamp pieces together and proceed to cut pins off, and after drawfiling spots where rivets have been to limits, start drilling holes in one end only. Make sure the holes are the correct distance from the end and centres.

Now reverse pieces end for end and after aligning sides and ends, use holes drilled as jig for drilling other end.

By means of pin plug in wholes proceed to reverse all ways, filing to the low edge until limit is reached, making sure edges are kept perfectly square. Finish edges to polish.

This will produce a templet that is symmetrical and an extra one is produced for practically the same cost and may be retained as a sample for filling in gauge room.

Some tool makers claim it is easier to make three on account of there not being the same tendency for rocking of file in finishing, and thus a truer edge may be obtained.

A FIXTURE ARRANGEMENT FOR GANG MILLING OPERATIONS

By SCRIBER

AN arrangement for gang milling a number of bearings at one setting is shown by the accompanying illustration Fig. 1.

This consists of a fixture in which is contained suitable locating pins and clamps for holding the work and as the arrangement for holding one piece would be the same no matter how many bearing are held at one setting, but one end of the fixture is shown.

The body of the fixture is indicated as A. and the work is indicated as B. When setting the work in the fixture it is located on three pins at C., D. and E. which three points bearing prevents the work from rocking, it is also located against the two pins F. and G., which therefore must take the thrust of the cut. To clamp the work securely in place the steel plate H. is provided, this has the front edge beveled to hook the corner of the work and the work is forced against this by the hinged clamp J. which is also beveled and pivots on the pin K. in the block L. This clamp is also beveled to hook over the corner of the work and bearings so gripped will be firmly held under heavy cuts.

A nut and ball washer M. complete the work holding arrangement and the fixture may be extended at the end where shown broken off to hold any number of parts up to the capacity of the machine. In the particular instance noted twelve bearings were held, while being machined as indicated by the x marks, a special gang of milling cutters Fig. 2. being provided for this purpose.

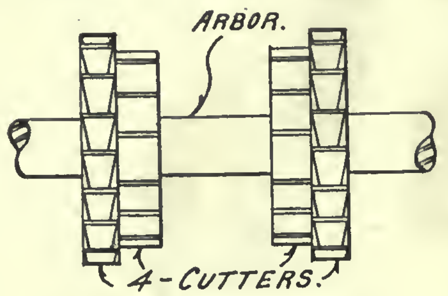


FIG. 2—MILLING CUTTERS

CENTER SQUARE

By C. E. H.

The center square here shown is by no means new, but it is much handier than the commercial article for striking the center on small round work on account of its lightness and balance.

The one I use daily was made from a piece of 1-16 in. tool steel and a couple of screws (see sketch), the heads being cut off after being screwed "home."

The plate was cut to approximate shape, drilled and tapped for the screws and trued up afterwards.

The line A.B. must be at right angles to C.D. and half way between the two

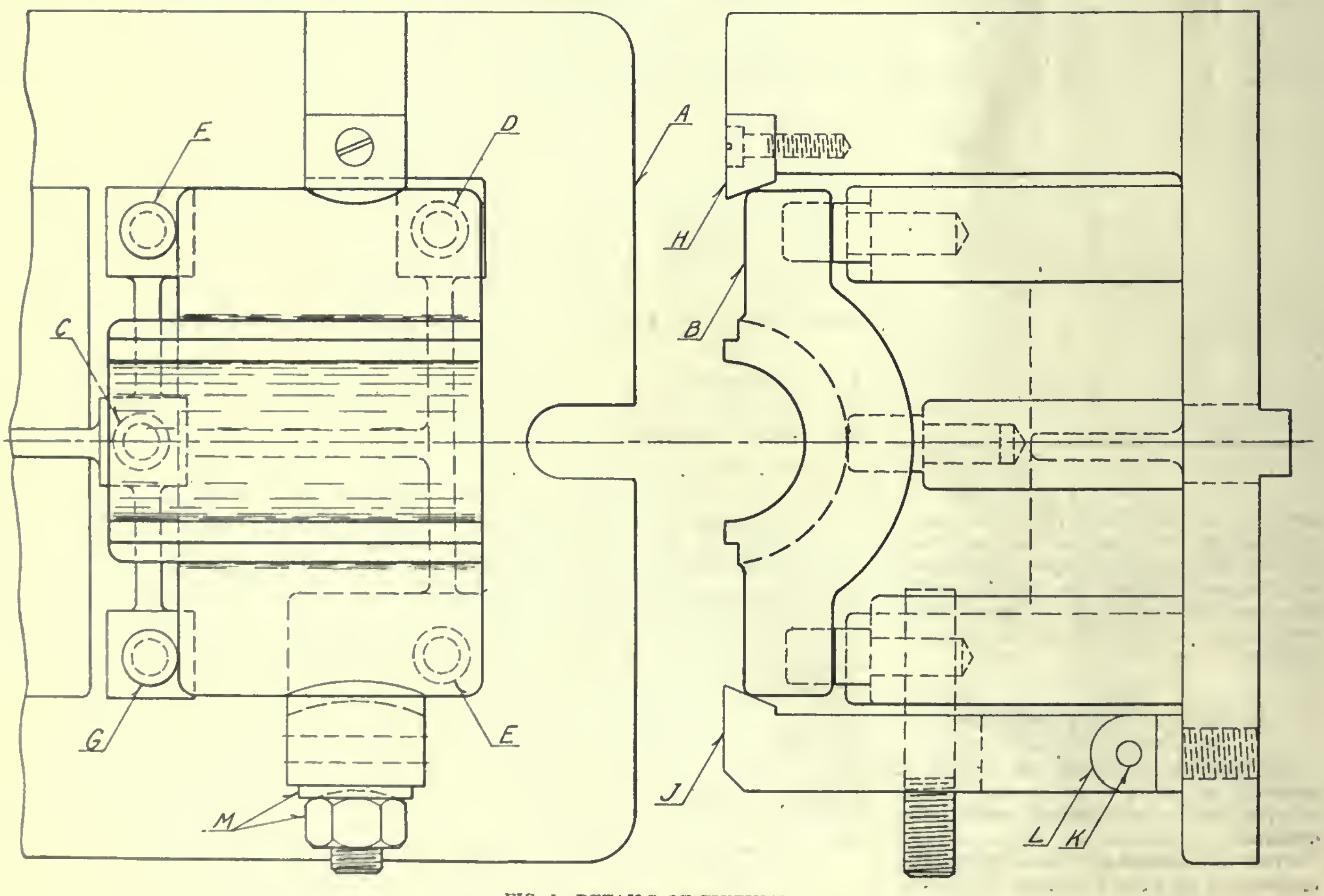
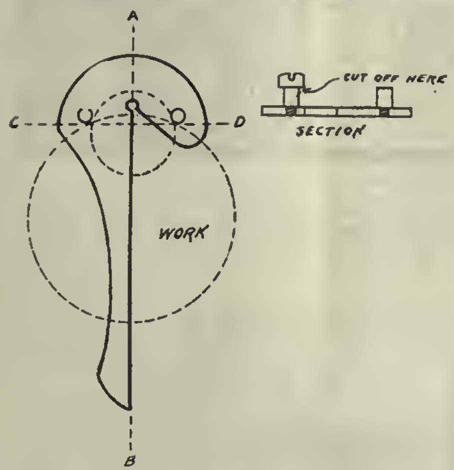


FIG. 1—DETAILS OF FIXTURE

screws, C.D. being tangent to the two screws.

The dotted circles on sketch serve to illustrate its use on round work of different diameters.

By placing the studs against the circumference of the work lines scribed along A.B. always intersect at the exact center.



CENTRE SQUARE

CRITICISM OF EACH OTHER'S WORK IS BOUND TO PRODUCE RESULTS

Dear Sir: In answer to your correspondent A. L. Haas, re line shaft repair. I quite agree with him in the cast of the shafting being of a light nature, and also, the work being the same, the ways and means mentioned would have been all right. As a matter of fact I have run a line shaft break with the aid of two lathe dogs with holes countersunk in the shafting to accommodate the set screws, but be aware it was in the case of a shafting 2½ inches diameter, also with setting shafting collars up tight against the hanger bearings. For a shaft of 6 in. diameter you are not always in a position to pick up a coupling of the above diameter and cutting the keyway would take almost as long as cutting same as I mentioned, and would also have had the trouble of losing about three large pulleys that were dead against the face of the hanger bearings and sliding; in any case one length of the shaft back to put on the coupling. As to solid drawn tubing that is out of the question in this case as I consider I would have a lively time in securing tubing of this size, and I think that it would not stand up to the work it had to do.

The pulley boss would be all right in some cases as I have also used this means of repairing a shaft, not a line shaft but one in a machine.

I must mention that in the case of the pair of collars the break was a direct and nearly even twist break as we found the same had been fractured for some time, as I should say 1-5 of the way through the break it was very rusty, which clearly shows my above statements to be correct.

If I am not mistaken I think the repair took us about nine hours or thereabouts.

I am pleased to know your correspondent took an interest in contradiction as to my method as it shows other ways and means of doing the job, and I have always maintained that if there were more of these good-natured criticisms of one another's work it would be much better for all concerned. Trusting I may have the pleasure of sometime renewing the acquaintance of Mr. A. L. Haas.

A. H. HOULDSWORTH.

INFLUENCE OF WAR CONDITIONS IN THE QUALITY OF GERMAN IRON

In the course of his explanation of the debased quality of German iron castings made under war conditions, Professor Osanne points out, as the cause of the undue hardness, with its bad consequences, a lack of silicon in the metal. Analysis frequently shows a percentage as low as 1.5 and 1.0. Moreover, the produce of one and the same blast-furnace varies in silicon content between 1.5 and 3 per cent. The difficulty is due to the interruptions of the supply of raw material. The requisite proportions are maintained as far as possible by an addition of scrap. But there is necessarily a falling off in silicon with every melting. Besides silicon there is a corresponding diminution of magnesium content To make matters worse, the proportion of sulphur and phosphorus is, from the same causes, no longer under control. The writer, in suggesting remedies, recommends the use of larger quantities of Luxembourg pig iron.—"Giesserei Zeitung."

TO ASCERTAIN THE SPEED AND DIRECTION OF AIRPLANES OVER THE WATER

The practicability of flying over long stretches of water is handicapped by the difficulty of determining the direction and speed of flight. Admiral Fiske proposed a means of overcoming this difficulty based on the idea of making an aeroplane follow the same general procedure as a ship does.

For long flights over water the machine should be made to fly quite close to the water and steer a straight course, not only laterally, but vertically, thus enabling the pilot to obtain information concerning the direction and speed of flight from the water itself by means of what may be called "an airplane log."

The direction can be ascertained by towing through the water a small object by means of a long and light steel wire. The small object will always be in the vertical plane containing the fight path, and the direction may be found by attaching the log line to the end of a pointer moving under the compass, or to a "dumb compass' kept in agreement with the compass.

To find the speed it would be necessary merely to tow a "Massey's log"—a simple contrivance towed by a ship and consisting of a sort of box fitted with a propeller that actuates dials on the surface of the box when it turns. The dials indicate the distance the box has been towed, and knowing the time, the speed can be determined. The error that might be made in calculating the speed is estimated at 2 per cent.—"Aerial Age Weekly."

WELDING CAR AXLES

The price of car axles has increased about 250 per cent. during the past three years, and deliveries are now very uncertain; hence broken axles should be welded whenever possible. By the electric arc method a good man can prepare and weld two 4-inch axles per day; the cost of a finished reclaimed axle is only about one-third that of a new one.

The axle is burned off by the arc to V shape, 5 or 6 inches inside the wheel fit so that only good "live" metal is used in the reclaimed axle. Two prepared pieces are laid in an angle iron with their V-ends together. They are then welded together, using a carbon electrode and cold rolled steel as filler. After the weld is partly completed the axle is rested on a simple trestle and filling-in is completed. The axle is then cut to length and machined. The weld comes nearly in the centre of the completed axle.—R. H. Parsons, "Electric Railway Journal."

HOLLAND'S COAL AND IRON TRADE IN WAR TIME

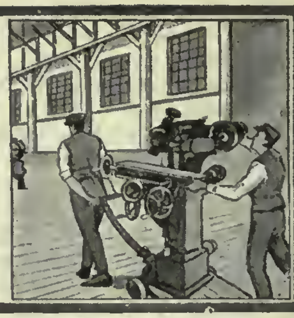
The degree in which Dutch industries have suffered from the war is indicated by the serious contraction of the iron trade in the last three years.

The imports of coal which reached 11¼ million tons in 1914 shrank to a little more than 2½ million tons in 1917. The exports amounted to only 58,000 tons in 1917, against 3,962 millions in 1914. The shrinkage in the iron trade has been no less serious. The imports of iron of all kinds amounted in 1917 to only 134,848 tons, against 647,224 tons in 1915. The exports in the same period fell from 171,990 tons to 7,117 tons. The deliveries of iron from Great Britain in 1916 were only a third of what they were in 1913. Since then a serious falling off has taken place. This shortage is compelling the Dutch to seek their supplies in Germany. —"Zeitschrift fur angewandte Chemie."

COVERING CAST-IRON WITH ALUMINUM

We learn from the "New East" that a process for covering the surface of cast-iron with aluminum has been discovered and tested in practice. The iron is first galvanized or tin coated and then plunged in a bath of molten aluminum at a temperature of 700° to 800° C. While in the bath the surface is rubbed with steel brushes. The tin or the zinc goes over to the molten aluminum and is replaced on the surface of the iron by aluminum. Two or three baths are required, but the larger part of the tin or zinc is displaced by the aluminum in the first bath. The advantages of the process are: remarkable firmness of adhesion, and economy compared with pure aluminum.—"Metall und Erz."

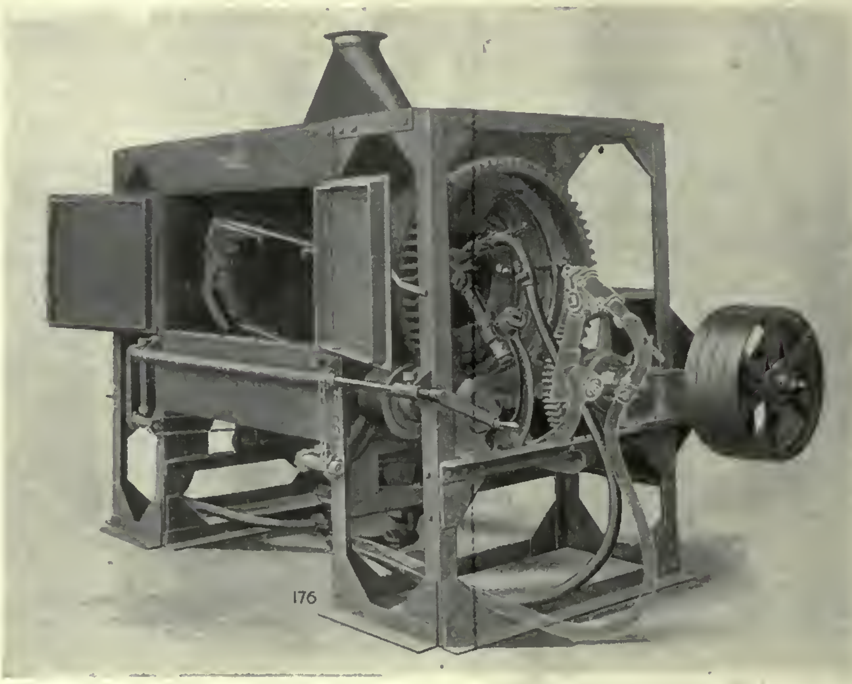
DEVELOPMENTS IN SHOP EQUIPMENT



Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

HORIZONTAL SAND BLAST MILL

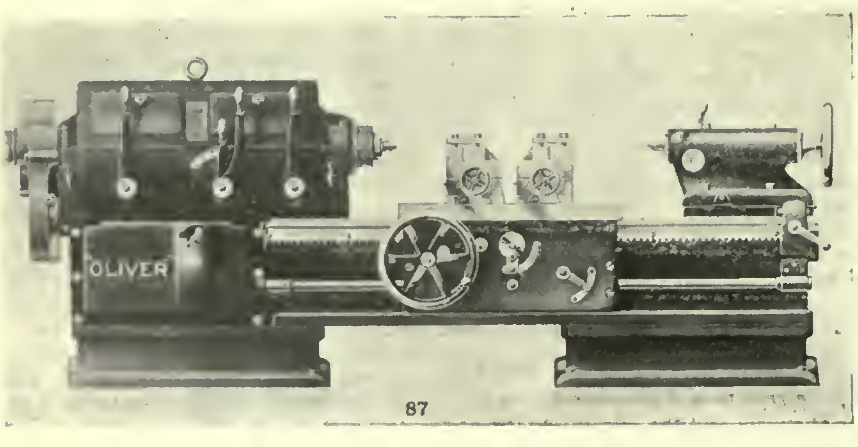
An interesting feature among the exhibits at the Milwaukee Foundrymen's Convention was that of the W. W. Sly Manufacturing Co., Cleveland, O., and which is illustrated below. This machine is known as the No. 30/40 sand blast mill, the barrel being 30 in. by 40 in. There are many new features embodied in the design of this machine, as for instance the motion of the barrel, which is both oscillating and rotating. The bearings are all of the roller type and are located outside of the housing so as to be completely protected from the action of the sand and dust. The sand blast guns are the Booster type, the efficiency of which is well known. The guns are mounted on brackets and can be adjusted to any desired position, and the bracket can also be thrown back as shown in the illustration. A very good feature of the barrel is the arrangement of the door, which is so constructed that it can be neither opened or closed until two levers on either end have been struck sharply. The position of these levers make it compulsory for the operator to have arms and head clear. The barrel door also locks automatically in the open or closed position. The door is made of ¾ inch steel plate and is strong and rigid. Care has been taken in the design to ensure ready access to all parts needing lubrication, inspection, and repairs.



SLY SAND BLAST DRILL

TWENTY-EIGHT INCH SHELL LATHE

The special heavy duty tool shown in the illustration is manufactured by the Oliver Machinery Co., of Grand Rapids, Mich. This machine has all-geared head with single pulley drive, and may be arranged for either motor or belt drive. It is somewhat of a single purpose lathe, the feeds being few and very heavy. The machine, which is of very rugged build, has been designed with the purpose of getting the very best results from high-speed steel. All the gears are of steel, and the pinions made from steel forgings. The spindle is forged from high carbon steel, and accurately ground. The bearings, which are made extra large, are fitted with replaceable bronze bushings, and are made adjustable to take up the wear. The apron is of the double wall type with removable front plate permitting the mechanism to be viewed at any time without the necessity of removing the entire apron. The controls are simple and well arranged.



OLIVER 28" SHELL LATHE

NEW HORIZONTAL BORING MILL

The demand for an ever-increasing supply of large machine tools by the different government departments and private manufacturers has been met by machine tool makers in a very satisfactory manner. A type of machine called for very largely is the horizontal boring mill of the floor type.

In this connection we illustrate this month a mill manufactured by the Giddings & Lewis Mfg. Co., of Fond du Lac, Wis., and described by them as No. 4 floor type boring, drilling and milling machine.

The machine has been designed with a view to adaptability, and the operations that can be performed on it include boring, drilling, milling, tapping, threading, facing, turning and slotting. The accompanying cut shows clearly the general arrangement of the machine. Following are some of the salient points in the makeup of the machine.

Floor Plate on Runway

The large floor plate is firmly bolted and doweled to the runway, both of which are supplied with generous-sized surfaces resting on the foundation. They are cross-ribbed and have metal properly distributed, thus making them strong enough to remain in perfect alignment after being properly installed. The "T" slots of the floor plate are conveniently positioned to receive the anchor bolts securing the work and they are machined out of the solid metal. The floor plate itself is machined all over, affording convenience in gauging and aligning the work.

The Column

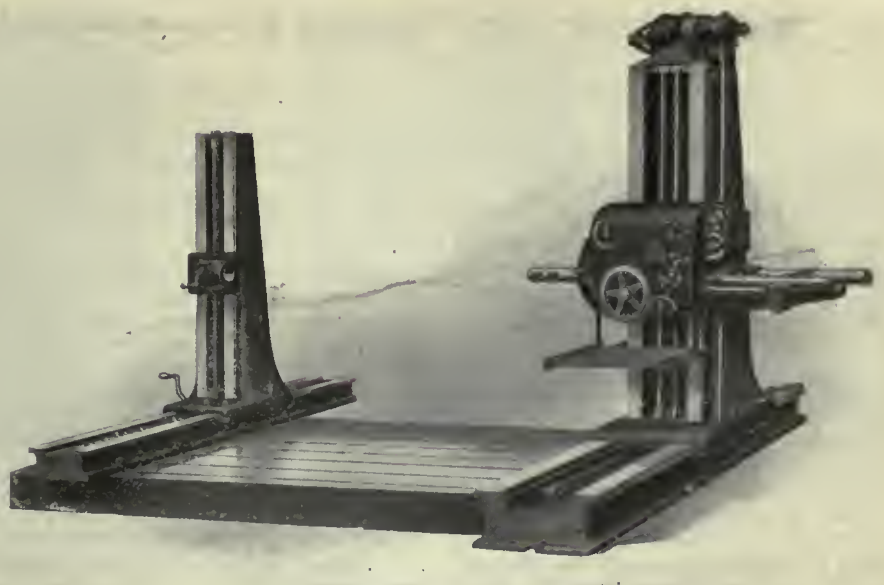
Great care has been taken to furnish the necessary strength for this important part. It is well ribbed, and has metal correctly distributed to withstand all unusual strains to which it is subjected. The base or bottom surface is supplied with an unusual spread in all directions where it rides the generous-sized ways of the bed. Lost motion between these parts is eliminated by means of long taper and square-locked gibs.

The End Support

While not subjected to the major strains such as the column, this part is made unusually strong in order to perform its functions when used as the outer support for long boring bars, etc. When necessary to use, and it is possible, this end support should be placed as close to the work as convenient. This is accomplished by sliding the piece over the top of the floor plate, it being guided by a long key. It is entirely independent from the rest of the machine and can be easily removed when it is desired to place extra large work on the floor plate. All of the adjustments on this unit are made by hand in the most convenient and accurate manner possible.

The Headstock

The headstock is of boxed design and unusual strength, furnishing perfect support to all of the moving parts. It has very large vertical and horizontal dimensions on the face of the column. Rigidity is obtained by means of two taper square-locked gibs. The face or outside surface is supplied with a cover which is removed to adjust the spindle sleeve bearing and other inside adjustments. Located on the top and within reach of the operator are oil reservoirs which supply lubrication for all of the bearings. From the bottom of this unit is suspended the operator's platform, which is designed to ride with the headstock at any position. When the headstock is at its lowest extreme the platform supports telescope and allow it to ride the ways of the bed. This platform places the operator directly before and convenient to all controlling mechanism and makes it possible to actively control the machine at all times, thus keeping it continually in the cut and making maximum efficiency possible.



NEW HORIZONTAL BORING MILL

The Spindle and Sleeve

The centre of the heat-treated, hammered high carbon steel spindle is positioned unusually close to the face of the column, eliminating an undesirable overhang. It is ground to exact size and the front end is bored to receive the Morse taper shank, tang, and drift key, while the back end is equipped with a ball thrust bearing, through which the feed is transmitted by the use of an extra long ram, carrying the rack, which disengages with the pinion at both extremes. The power is transmitted to the spindle from the sleeve by means of two long spindled keys, diametrically oppo- up collet is provided and by its proper adjustment the slide of the spindle is made snug, thereby allowing for precision alignment. The sleeve, like the spindle, is made of heat-treated, hammered, high carbon steel, and is of unusual length and strength. It is rigidly supported in two generous-sized adjustable bronze bearings placed far apart. Each of these bearings is independently adjusted for taking up wear, thus eliminating all lost motion. The front face of this sleeve is prepared to receive milling cutters and attachments.

To the spindle sleeve are secured two large driving bull gears. The front or face gear, being the larger, receives its power through the sliding back gear shaft. The power is transmitted through the variable speed unit located at the upper right-hand corner of the headstock. This selective gear speed unit contains heat-treated steel clash gears, cut with stub teeth to provide additional strength and ease of operation. The high speed shafts in this unit are ball seated and all heavy-duty shafts have generous-sized phosphor bronze bearings.

BONUS SYSTEM FOR ECONOMY OF COAL IN GENERATING STATIONS

It is argued that it is desirable to encourage economy in the coal consumption in generating stations by interesting the employees in the saving by a bonus system, according to which the money saved is equally divided between the employees and the undertaking. The division commences as soon as the consumption of coal falls below a certain limit. This limit is set according to a calculated consumption based on the efficiency to be expected from the plant if run with care. In a calculation concerning a special installation with a peak load of 25,000 k.w. and a wage bill of Fr. 700 a day, the consumption limit from which the bonus should commence is found to be 6,400 calories per k.w. hour.—L. Conge, "Revue, General de l'Electricite."

LIFTING HEAVY PARTS FOR MACHINING

By D. S.

In a great many instances where heavy stuff has to be fixed in machines too much reliance is placed on manual labor, both strength and time being rather uselessly wasted in this kind of work. If a piece of metal or other material can be mechanically lifted and slung into position, say over a lathe there only remains the adjustment of position to be dealt with, and this is easier to manage with a slung article than with one supported by men's arms, let the men be as experienced and careful as they may. The methods of slinging will probably depend on the conveniences possessed by the machine shop, and will vary between overhead runways which will serve a long line of machines, to small portable cranes which move about on wheels, the matter being one of both cost and convenience. Whatever is used, however, it should be capable of holding the slung article in a convenient position for fixing, and in addition to the lift from the trolley or other carriage on which the article is brought up, should be clear of the machine itself, for very obvious reasons. A large saving can be made by using appliances of the kind with reduction of cost.

Modern 150 Ton Track Scale Now in Use

No Knife Edges Employed, but Plate Steel Fulcrums Used Instead —Assembled by Locomotive Crane—Scale Pit is Heated by Hot Water System—Great Advances Made in This Work

By FRANK C. PERKINS

THE accompanying illustrations, Figs. 1, 2, 3 and 4, show the details of construction of the standard railroad track scale, developed at Pittsburgh, Pa. These photographs of this modern 150-ton railroad track scale show the mechanism at close range, with six of the eight central transverse levers connected with the longitudinal levers plainly visible. The bearing on high stands will be noted supported on concrete piers. The opening in transverse levers provides access to alignment of girders on lever system by adjustment of nuts under girder.

The weigh beam house of this 15-ton railroad track scale has convenient windows for observing movement of cars. The uncovered scale shows the deck beams supporting the dead rails; also shorter steel ties supporting the live rails. By varying thickness of rail bases on top of beams all four rails are on the same level.

It is pointed out that the building of modern scales by the aid of a powerful crane reduces the cost of erection and the men work under safer conditions. The illustration Fig. 4 shows the placing of steel ties for weigh rails upon the powerful girders, freely suspended upon the lever system, prior to the setting of the longer deck beams.

The Pennsylvania Railroad Company installed the first two section plate fulcrum track scale. This construction marks great advance in the development of weighing machines for heavy service conditions. It eliminates entirely the need for regrinding or renewing knife edges and bearings, which has been a source of heavy expense and annoyance at busy weighing points. It also eliminates the dead rails with their attendant switches and signals. Relieving gear, which has heretofore been used as a substitute for dead rails, is also rendered unnecessary by the plate fulcrum construction and a permanent installation is obtained which will effectively withstand the heaviest service conditions and give accurate weights for fifty years, without any necessity for renewal of parts.

The plate fulcrum track scale has plate fulcrums which are substituted for the regular knife edges and bearings which heretofore have always been used in track scale construction. The plate fulcrums are formed with a relatively thin central portion, connecting two heavier portions or heads. The thin portion forms the plate and gives the desired flexibilty, while the large heads distribute the load on the supporting members and decrease its intensity and, in addition, furnish a ready means for attachment to the levers and the supporting stands. The thin central portions are all arranged so as to act in direct compression and are subjected to a slight flexure as the weighing beam vibrates and the lever system responds to the condition of balance.

The plate fulcrums used as the load plates in the main levers as noted in drawing Fig. 5. This plate fulcrum is a piece of rectangular steel reduced to a thin web section in the centre, thus forming a thin plate of steel which acts in compression under the load imposed on the weighing rails. With this construction the possibility of wear is entirely eliminated in the vital parts of the scale. Wth the knife-edge construction, when the scale is new there is practically a line contact between the knife edges and the bearing steels, but in the course of time the bearing surfaces increase and the knife edges are said to be dull or blunt. When this condition exists, inaccuracies are introduced into the weights and it is necessary to repair or renew the pivots and bearings if accurate weights are to be obtained. With the plate fulcrum construction, any possibility of such wear, with subsequent inaccuracies, is entirely eliminated, as the thin plates of steel remain in their original condition regardless of the amount of weighing that is done on the scale.

The scale is installed in a concrete pit as the foundation piers and walls are heavily reinforced with twisted bars. The inside length of pit is 69 ft. and its inside width measures 10 ft., the height from top of foundation piers to base of rail being 10 ft. 6 in. and the distance from centre line of scale to centre line of weighing beam is 10 ft. for an effective weighing rail of 52 ft. The additional length of pit is used to provide approach spans supporting a short section of rail which is independent from both the main track and the weighing rail.

The weighing rail is supported on cast iron rail stands, which in turn rest upon steel cross ties supported on the main girders. The rigid deck type of construction is used and the deck is composed of 5-16 in. steel plates supported on 12 channels which rest on bearing plates supported by a ledge in the side walls of the pit. These channels are curved so as to give a crowning effect to the deck, which will effectively shed surface water. The steel plate is covered with ¾ in. cork brick.

The scale assembled before being installed may be noted in Fig. 6, while

FIG. 1 WEIGH BEAM OF 150 TON TRACK SCALE

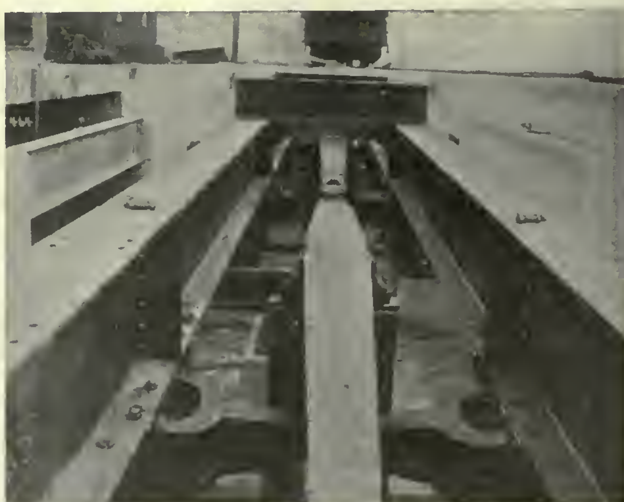


FIG. 2 -MECHANISM OF 150 TON TRACK SCALE

FIG. 3—CENTRAL TRANSVERSE LEVERS OF 150 TON

FIG. 4—150 TON TRACK SCALE

Fig. 7 shows the main and longitudinal extension levers. In the photographs Figs. 8 and 9 may be seen the beam poise and the weigh beam of this plate fulcrum track scale. This scale is of the two-section type wherein four main levers transmit the load to two longitudinal extension levers which in turn transmit to a transverse extension lever and this lever is connected directly to the weighing beam. The main and longi-

FIG. 5—DETAIL OF TYPICAL PLATE FULCRUM

tudinal extension lever stands are directly supported on massive base castings which rest directly on the concrete foundation. Only seven levers are used in the scale, thus making a remarkably simple and effective construction and eliminating entirely the complication of intermediate sections which is encountered when the four-section type of scale is used. The main girders are so designed that a test car may be placed directly over the center line of a section.

It is claimed that this has never been practical wtih track scales built in more than two sections. An effective means is thus provided for accurate calibration, and as there are only two sections in the scale the final adjustment in the field is extremely simple. The main bridge is constructed of two plate girders, one on each side of the scale. They are 5 ft. 2 in. deep, back to back of angles, and reduced to 2 ft. 7 in. back to back of angles, where they are supported on the scale sections. Three top and bottom flange plates are used, 17 in. x 9-16 in. The flange angles are 6 in. x 6 in. x 9-16 in., and the web plates are ½ in. The girders are securely tied together by means of transverse and diagonal bracing so that a very rigid brindge construction, which will effectively resist longitudinal and lateral strains, is produced.

The steel cross ties are composed of 10 in 35 lb I beams, and these are securely riveted to the top flange of the girders. The railstands are supported directly on the cross ties. The approach spans are composed of 18 in. 70 lb. I beams, which are supported on base plates provided with spool bearing which provide a means for the alignment of the approach rails with the weighing rail without any distortion or springing of the rails. The 18 in. I beams in turn support a steel casting which furnishes a support for an intermediate rail stand under the approach rails. These rails are 6 ft. 8 in. long and are independent both of the weighing rail and the rails in the main track.

The rail stands are designed to shed the surface water. This is accomplished by two umbrella flanges, one above the deck and the other below. The top flange will shed the most of the surface water away from the opening in the steel deck. The lower flange in turn sheds the small amount of water which may pass through into a water trough under the deck and a system of spouting is arranged to convey the water to a pump in the bottom of the pit.

The lever system consists of four main levers made of steel castings and each lever is arranged to support three plate fulcrums. For the reception of the load plate, a rectangular recess is provided of sufficient width to accommodate both the head of the plate fulcrum and a clamping block. One side of the head is vertical and engages with the vertical side of the recess. The other side is tapered and engages with a corresponding taper on one edge of the clamping block. The opposite edge of the clamping block is vertical and engages with the vertical edge of the recess opposite to the plate fulcrum when in position. The clamping block is arranged so that its lower surface does not engage with the bottom of the slot in its final position and it is forced down into position by means of cap screws. This action forces the plate fulcrum head firmly against the side of the recess and retains it in a fixed position. The butt and tip ends of the levers are provided with square seats, which form supports for the end plates.

The end plate fulcrums are drilled through the heads and securely attached to the levers to cap screws. The design is so arranged that the load is trans-

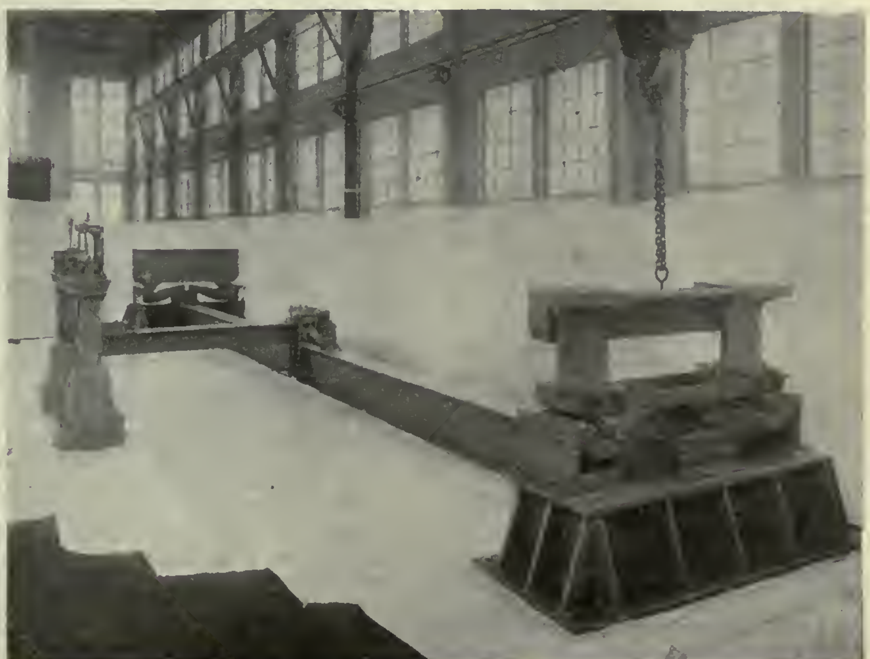


FIG. 6—THE SCALE ASSEMBLED BEFORE OPERATION

ferred directly to the solid portion of the lever and the cap screws are relieved of all shearing strains. The seats for the plate fulcrums are very accurately machined so as to maintain the true theoretical distance between the centre lines of the plates and also to preserve their exact parallelism. The longitudinal extension levers are composed of 20 in. 140 lb. Bethlehem girder beams to which are attached at the butt ends heavy steel castings for carrying the plate fulcrums.

Heavy steel castings forming angle plates are provided at each side of the web and these plates are held in position by means of tapered bolts accurately fitted into reamed, tapered holes. The casting carrying the plate fulcrums is in

FIG. 7—MAIN AND LONGITUDINAL EXTENSION MEMBERS

turn secured to the reinforcing angles and flanges of the I beam by tapered bolts which are made a driving fit into reamed, tapered holes. The plate fulcrums are supported in square, truly machined seats and are held in position in the same way as the end plates in the main levers. Bearing plates are applied to the tip ends of the levers and are held in position by means of bolts and dowel pins. These plates are provided with longitudinal recesses which form sliding ways for the nose irons.

The nose irons are steel castings provided with truly machined seats for the heads of the plate fulcrums, which are used at the end. They are held in position on the levers by 1¼ in. studs. Adjustment of the nose irons is furnished by means of non-corrosive adjusting screws. The transverse extension lever is composed of a 10 in. 105.5 lb. Bethlehem H beam and is furnished at the butt end with a heavy steel casting for the support of the plate fulcrums. This casting is secured to the I beam by means of tapered bolts, accurately fitted into reamed, tapered holes. The nose iron is of cast iron and the plate fulcrum is held in position in the same way as in the nose irons for the longitudinal extension levers. It is held in position by 1 in. studs and adjustment is provided by means of a non-corrosive adjusting screw.

The multiplication of the levers is as follows:

	Multiple
Main levers	3½
Longitudinal extension levers	20
Transverse extension lever	11 3-7
Butt of weighing beam	800

The lever stands are steel castings designed with a single web section connected to a heavy lower flange. They are accurately machined for the support of the plate fulcrums, the seats being made in the same way as the end seats in the main levers. In the plate fulcrum construction it is necessary that one of the plate fulcrum heads be attached to the lever and the other to the lever stand or to the block transmitting the load so that it is necessary to provide accurately machined seats both in the levers themselves and in the lever stands and bearing blocks. The lever stands for the main and longitudinal extension levers are directly supported on two main base plates, one at each end of the scale.

Each base plate provides support for two main lever stands and one longitudinal extension lever stand. The stands are bolted to the main base plates with 1 in. bolts, and after their proper location has been determined so that both the main levers and the longitudinal extension levers can be assembled and connected without introducing any initial strain in the plate fulcrums, the stands are permanently maintained in a true and accurate position by two ⅞ in. dowel pins passing through the lower flange of each lever stand and the upper flange of the main base plates. The main base plates are 24 in. deep and are heavily ribbed so as to effectively transmit and distribute the load over the concrete foundation.

The transverse extension lever stand is supported on an independent base casting of ample proportions to distribute the load evenly over the foundation. The base plates are accurately machined on both the top and bottom surfaces so as to provide a true seat on the top surface for the lever stands and to provide a true and even surface to rest on the concrete. The piers supporting the base plates were hammer dressed and rubbed down so as to have them true and level, as it is very essential that the base plates should be maintained in a truly level position, and in order to overcome any slight inequalities that may have been left in the concrete foundation a ¼ in. thickness of "linotype" was used between the concrete foundation and the base plates. One and one-eighth inch "cinch" expansion bolts are used for holding the base plates in position.

The longitudinal extension levers are connected to the transverse extension lever by means of radial struts which are furnished with hardened curved steel surfaces in the lower portion which engage with hardened steel-bearing plates supported on a platen, which in turn is suspended by substantial rods from the bearing block engaging with the load plate in the transverse extension lever. The bearing plates are encased by housings which are designed so that they can be adjusted in the longitudinal direction and they are operated by means of non-corrosive adjusting screws. This is necessary so as to enable the radial struts to be maintained in a vertical position, should there be any adjustment of the longitudinal extension lever nose irons. The transverse extension lever is connected to the butt of the weighing beam by means of two suspension rods supporting a platen which in turn supports a radial strut connection directly attached to the end plate fulcrum. In order to prevent any possibility of displacement at theh ends of the longitudinal extension levers a transverse stay plate is provided. This plate is attached at one end to the lower platen and at the other end it is anchored to the base of the transverse extension lever base plate. A stay plate is also provided at theh tip of the transverse extension lever. In this way the true position of all the extension levers is very accurately maintained.

As to the bridge supports it may be mentioned that heavy steel castings provided with accurately machined slots for the reception of the intermediate or load plate fulcrums in the main lever furnish a means for the transmission of the load to the lever system. The slots in these castings are tied together in the trans-heads of the plate fulcrums in the main levers are a "sucking" fit therein. The castings are tide together in the transverse direction by means of tie bars, and after they have been accurately spaced so as to maintain the plate fulcrums in a truly vertical position they are held in position by means of ⅞ in. dowel pins. The main bridge is fixed at one end and free to move at the other. The fixed end is supported by means of a transverse I beam engaging directly with the bearing castings above referred to.

It will be seen that the movable end of the bridge is supported on cast steel struts provided with hardened steel inserts, ground to a radius, and engaging with hardened steel plates at their top and bottom surfaces. The lower plates are directly supported on two steel castings similar to those described for the transmission of the load at the fixed end. The housings are provided for the steel

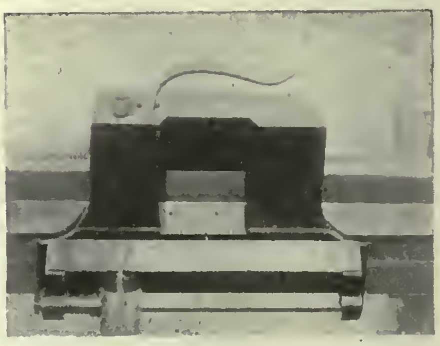


FIG. 8—BEAM POISE

bearing plates and adjustment is provided in the longitudinal direction by a non-corrosive adjusting screw so that the struts may be placed in a truly vertical position when the bridge is in its normal longitudinal position.

There is a heavy casting directly connected at the movable end to the main girders by means of 1 in. bolts and a layer of stereotype metal is used between this casting and the lower flange of the main girders. The top bearing plates engage with this casting and are secured in position, as adjustment is not necessary at the top of the struts. Recesses are provided at the top and bottom bearing plates in which oiled felt is inserted so as to prevent rusting of the rocker or the housing. This felt is in turn protected by means of shields, which are secured to the struts by means of cap screws.

The main bridge is checked in the longitudinal direction by means of a stay plate 44 in. wide by 1 in. thick, reduced to ¼ in. at each end so as to allow for flexure. This stay plate is secured to the girders by means of a heavy transverse connection and is anchored to a cast steel transverse support which in turn is securely anchored to the foundation. The transverse checking is arranged with a substantial connection to the transverse support at the movable end of the bridge and is connected to a rigid support attached to the side walls of the pit. These transverse checks are composed of two rods 2⅛ in. in diameter and reduced to 1½ in. in diameter at each end to provide for flexure.

The weighing beam noted in Fig. 9 is of open hearth steel machined all over. It is notched, fitted and sealed with the utmost care and is supported by means of plate fulcrums of the proper dimensions to give the requisite strength and the necessary flexibility to insure a sensitive scale. It is provided with an indicator which moves over a graduated scale and thus furnishes a means for taking a very exact balance.

There is a locking device provided so that the beam can be securely locked when the scale is not in operation. This device consists of an eccentric which engages with a flat spring so that a pressure of 15 lbs. is applied at the permanent beam stop. A stabilizing weight is located exactly over the fulcrum and is provided with vertical adjustment so that the period of vibration of the beam can be changed at will so as to suit local weighing conditions. Immediately over the indicator fulcrum a small vertical weight is applied, which is provided with screw adjustment in the vertical plane. This has the effect of changing the sensibility of the scale, which can be adjusted to suit local conditions.

There is an oil dash pot provided at the tip end of the beam so as to steady its motion. The beam is graduated for the main beam 300,000 lb. by 1,000 lb. notches and the fractional bar 1,000 lbs. by 50 lbs. An auxiliary weight of 100,000 lbs. capacity is furnished so that it can be applied at the tip of the beam to give a total weighing capacity of 400,000 lbs.

The balance of the beam is obtained by means of two sets of balance weights, one being arranged at the back of the beam for rough adjustment, the final adjustment being obtained by means of a balance weight provided at the butt end and held in position by means of a knurled lock nut.

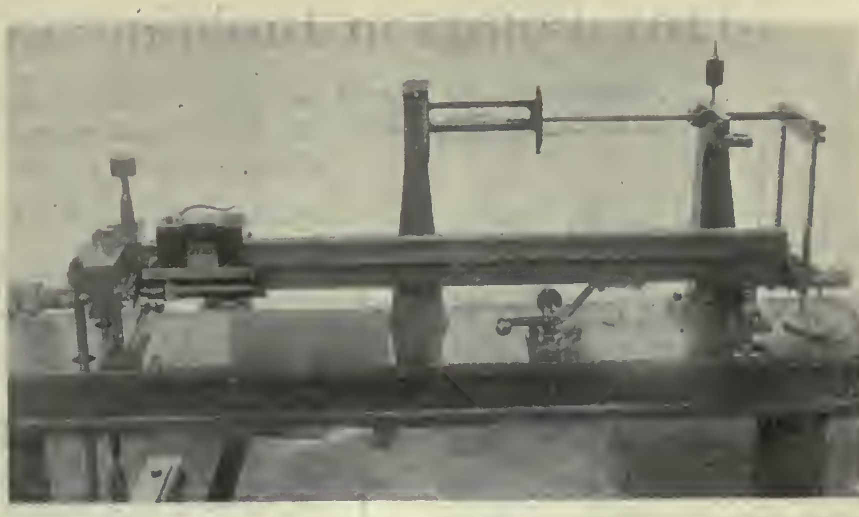


FIG. 9—WEIGH BEAM

The poise is noted in photograph Fig. 8 and is fitted with ball bearings and centre indication is provided for the faces of the main beam and the fractional bar are made of "Monel" metal and the figures and graduations are filled with red. The beam is supported on a well-proportioned metal sheif which in turn is supported on two metal pillars resting on sub-bases which are provided with means for transverse adjustment of the beam outfit so that if it is necessary to move the nose iron in the transverse extension lever a means is provided for preserving the true vertical position of the beam rods.

It is of interest to note that the plate fulcrums in the main and extension levers are composed of high grade chrome vanadium alloy steel with a tensile strength of 200,000 lbs. per square inch. They are truly machined to dimensions and are accurately fitted in the levers. The plate fulcrums in the weighing beam are made of high grade "blue strip" steel. All the plate fulcrums are so designed that when the slight flexure occurs the stresses induced are well within the elastic limit, so that no permanent distortion can occur.

It may be mentioned that the scale pit is heated by means of an efficient hot water system, sufficient radiation being provided to maintain a temperature of 60° in the pit. A number of electric lights are installed so as to properly illuminate the pit so that proper inspection can be made of all parts of the mechanism. The beam outfit is installed in a scale house furnished with a large bay window which gives the weighmaster an efficient view of the scale rail. The height of the indicator from the floor has also been very carefully considered so as to place it in the most desirable location for the weighmaster so as to facilitate the quick balancing of the scale when cars are being weighed in motion.

LINING ROUGH EMERGENCY CRUCIBLE FURNACES

By M. M.

Given an old sheet iron oil or paint drum, about 20-inch. diameter by 30-inch. deep some means of producing blast, if only from a portable forge, a 30-lb. or 40-lb. crucible, and some coke of anthracite, if you line the drum with some fairly refractory material, you can melt anything up to copper. Sandy brick earth, clay, sandy silt from the riverside, scraping off a stoned road—not limestone — and other earths will answer fairly well for a few melts, if dried before firing takes place, and make passably good makeshifts for good linings, but of course, a fire-clay that will burn hard or a good ganister is best, owing to its greater durability. With a little ingenuity, however, emergency melting can be done readily if a little thought is given to the matter.

WATERPOWER

By T. H.

The new Galloway Engineering Works, erected in the south of Scotland, mostly in reinforced concrete, is fitted with a hydro-electric equipment. A dam in mass concrete, 6-feet clear above ordinary water line, battened on to upstream side, strengthened by buttresses, has been built half across the river; from the pool to the headrace a channel, 214-feet long, 13-feet broad and 7-feet 6-inch. deep has been erected in reinforced concrete, Kahn rib bars being used. A good head of water is obtained throughout the year, without interfering with the salmon fishing on the river in any way. The works are approached across the headrace by a reinforced concrete bridge of 15-feet span and 9-feet wide between the parapets, which are panelled capped, by an overhanging coping. These parapets form the main beams, which cross beams at 5-feet centres, supporting 6-inch. reinforced concrete slabs, the whole being designed to carry a 5-ton wagon.

Many Points in Building an Export Trade

Apparently the World is Full of Markets, but the Great Task is to Get Into Them—France Wants to Secure Canadian Goods For Reconstruction Period

EXPORT trade, both for itself and in relation to demobilization and reconstruction, is a practical proplem to be faced immediately. The presence, in the deputation that interviewed the Cabinet in Ottawa, of James T. Gunn, vice-president of the Labor Party of Greater Toronto, indicates that the matter is not wholly for the employers to decide, but that the workers also must have their voice.

It is estimated that, with the coming of peace, between 600,000 and 700,000 Canadian men and women would be released from military service or from purely war industries. With their families, a million and a half or perhaps two million people will be affected in the readjustment period.

Various plans to provide employment are already under consideration, including land settlement and large public works, but industrialism must do its share. The home market in itself must be developed, but that alone is not sufficient. A greatly increased export trade must be sought.

Europe and Russia

What is the market for such a trade? For one thing, there is the physical reconstruction of the devastated areas. In 1917, the loss of industrial, agricultural and public property in France, Belgium, and the eastern theatre of war alone was estimated at $6,000,000,000. Since then, other billions have been added to this total. There will be a demand for lumber, furniture, railway equipment, building supplies and agricultural, mining and electrical machinery. There is also the field of **Russia**. The Government has appointed a commercial commission to study the possibilities there. Binders and tractors will be needed, and all sorts of farm machinery, including equipment for the flour milling industry.

There is no lack of markets. How can Canada get her share of the business? In export trade, volume is essential, and in this country there are probably not very many industries which have sufficient resources to enable them to penetrate by themselves into forign markets.

It is advocated in some quarters therefore, by Hon. Frederick Nichols for example, and by the Canadian Industrial Reconstruction Association, that there should be a combination or federation of kindred industries, with common shipping anl common selling agencies.

It is true that in Great Britain and in the United States, such federations for after-war trade are being formed. The British Trade Corporation, with a capital of $500,000,000, has been organized to ensure credits, give financial backing to British enterprises througout the world, and to furnish information as to opportunities for trade extension in foreign countries. Among other bodies is the Federation of British Industries, which is spending $12,500,000 to stimulate exports.

In the United States similar tendencies are at work. The Webb law reverses previous American policy and permits combinations of producers and manufacturers for export business. A federation of industries, including 300,000 plants and 10,000,000 workers, is being organized.

Such developments are not without their serious potential dangers. Combines in the past have not been popular, nor have their results been beneficent. If, to face new conditions, combinations or federations (which would probably be looser ehan the old combines) should spring into existence here, their activities would have to be carefully scrutinized and a constant watch kept over their tendencies.

Here is where labor figures. Such federations of industries, if they are to exist at all, should be humanized by the direct participation of labor in their management. Democratic control of industry is a slogan which is sure to grow

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VETERAN MANUFACTURER'S VIEWS ON THE CLOSE OF THE WAR

By JOHN McCLARY, President, McClary Mfg. Co.

I predict that at the close of the war there will be such a rejoicing that for a time the disturbed future will be overlooked. The war has created a condition that will require the united wisdom of our ablest statesmen to meet, and do justice as far as possible to our returned soldiers, to labor, and to the general public.

Bonar Law, many months since, issued a statement to the British public that, after the return of their triumphant soldiers, it would be as great, or nearly as great, a task to absorb them as it was in the first place to create them. They would have to be kept employed and well paid if they did not earn half their salaries —intimating the necessity of producing merchandise beyond the requirements of the limited, disturbed, world's market, and citing pig iron as an illustration which would not depreciate in carrying. These conditions apparently could only be carried through by the action of the Government. These views reflect to some extent, what we may look forward to at the close of the war.

The first effect on our cities will be the stoppage of production of war materials. These highly paid artisans engaged in this work would be thrown idle. The inflated prices of merchandise, running from one to three hundred per cent., must suffer a gradual sinking back to more normal levels. The raw materials of the McClary Manufacturing Company average, upon the whole, fully three times normal prices of metals and other products consumed.

The first effect of the closing of the war will be to create a waiting condition. Outside of food, the average consumer will purchase only for immediate requirements. The manufacturer, in most lines, will only produce reduced outputs to even up his stock, looking forward to his raw materials gradually shrinking back to the former normal prices. While he has a duty to perform to employees as far as conditions reasonably permit, there is likely to be a largely reduced number of operatives, with a corresponding reduction in salaries, having an unfavorable influence on trade in our cities. Many trades now doing apparently a prosperous business will find their sales reduced, and their stocks carried depreciating from month to month, causing, I fear, many failures, especially among traders who have kept their stocks up to normal, assuming the present inflated prices would continue.

The depressed conditions will continue more or less for a period, I assume, of twelve months or more.

The farmer will continue to be comparatively prosperous, the purchaser of merchandise for immediate requirements.

in strength both in England and America in post bellum days. If the workers did have a greater share in the management and operation of industrial establishments, if they were given more responsibility for production, like the coal miners in Pennsylvania, and, at the same time, more privileges and rewards to match the responsibility, then neither single industries nor groups of them would be sources of dissension or rancor.

FRANCE WANTS CANADA'S HELP FOR PERIOD OF RECONSTRUCTION

WITH Canada aproaching the period of reconstruction when war industries must be readapted to peace activities and new trade secured, it is encouraging to note the possibilities of greatly improved commercial relations with France. At the recent meeting of the Canadian Reconstruction Association at Montreal, Senator Beaubien emphasized the desire of the Republic for increased trade with the Dominion. "Deeply moved by Canada's effective co-operation in the war," he said, "France seems anxious to show her appreciation of our efforts. Inspired by that desire, the Comite Franco-Amerique, which is presided over by Monsieur Gabriel Hanotaux, and whose principal object is to extend to the fields of industry the close relations now welding Canada and France on the fields of battle, has called the attention of its Canadian section to the great trade opportunity afforded in reconstruction work necessary to restore the devastated areas of France. It points out that many nations are already eagerly seizing this opportunity and strongly urges Canada to do likewise. The Canadian section of the Comite Franco-Amerique has already recommended to the Government that an Honorary Commission, assisted by experts if necessary, be appointed to ascertain what Canadian products could be furnished for the work of reconstruction in France, pareicularly such products as can be standardized and provided in large quantities. The Canadian Association further suggested that this Commission should negotiate with the French Government "with a view of having France, as a nation, purchase large quantities of such standardized products with the understanding that the orders for such materials would be handled by Canada in the same manner and through the same channels as war orders."

In supporting measures for greater trade with France, Senator Beaubien submitted some striking figures of our present exportation to prove that large orders can be secured from the Republic. Within the last two years orders have been placed in Canada for very large amounts of metallurgical products. One enquiry received by a consulting engineer in Montreal was for no less than 250,000 miles of cable exceeding in price $10,000,000. Tremendous quantities of material are required by the French State Railways, including:

Wheels for locomotives.

Wheels for freight and passenger cars.

Straight axles for locomotives, freight and passenger cars.

Bent axles for locomotives.

Locomotive steam cylinders.

Cast steel lubricating boxes.

Cast iron lubricating boxes.

Iron, brass and bronze castings.

Round, flae and square steel bars.

Steel castings.

Steel billets, spring steel.

Helicoidal and spiral springs.

Steel shapes.

Spikes, cut and wire nails.

Iron fittings, spare parts for freight and passenger cars.

Copper and steel fire-box plates.

Rails, bars and splices.

Traction chains and hooks.

Drawn and seamless steel, copper and brass tubes.

During September enquiries were received at the French Chamber of Commerce for shoes, hardware, lumber, foodstuffs, canned goods, prepared furs, glassware for electric light, lard, bacon and smoked ham, toys, maple syrup and tree felling and cutting machines.

The present demand for window ashes and doors alone in the devastated areas in France would supply a splendid market for Canadian factories, but as Senator Beaubien pointed out, prior to the war and even up to two years ago, the major part of ready-made wooden doors sold on the Canadian market were manufactured in the States; most of them came from the middle West, many even from the State of Washington. A substantial proportion were made out of Canadian lumber. In other worls, American doors dominated the Canadian market despite the fact that these articles had to bear the extra cost of long railway haul and of Canadian duty which alone added practically one-third to their cost price. The reason for such an extraordinary state of things Senator Beaubion declared was the failure of Canadian manufacturers to Standardize their products. As he said, "with their enormous markets the Americans can specialize in one product and by producing enormous quantities reduce cost price to a minimum." Standardization is one of the outstanding features of British and American trade preparations. The question should be given the earnest consideration of Canadian manufacturers.

JAPAN BUSY LOOKING NOW FOR OPENINGS FOR HER EXPORT TRADE

AGENTS of Japanese syndicates are reported to be negotiating for the purchase of a large number of mines, flour mills, brick works, saw mills, and other industrial undertakings; while commercially they are making every effort to extend their influence. The Japanese firms, which for the most part have only recently been established at Vladivostok are enlarging their operations and endeavoring to secure as large a share as possible of the trade of the territory. The scouts of these firms are reported to be scouring the country for scrap iron, hides, wool and other Siberian and Manchurian products required in Japan. Since the outbreak of the war Japanese products have been exported to Siberia in large quantities, and are to be seen in all the shops and in the bazars. In comparison with the same period last year the figures for the export of Japanese goods to Siberia show an increase of 687,628 yen.

Wages Question Decided at Ottawa.

Provision Made for Altering Scale According to the Cost of Living

The Labor Board of Appeal's report in the appeal of several Toronto firms, members of the Employers' Association of Toronto, from the award of the Board of Conciliation which considered the dispute between the firms and their employees, blacksmiths and engineers, was made public to-day. It shows that the report of the Board of Conciliation has been modified in a few respects to the benefit of the appellant firms. The Board of Conciliation granted the boilermakers an advance of 3½ cents, bringing their rate to 58½ cents per hour. The rate of pay for general blacksmiths is reduced from 68 to 62½ cents per hour. and forging machine operators reduced from 60 cents to 57½ cents per hour per hour, and with these amendments the schedule fixing rates of pay is confirmed, and men at present receiving more than these rates shall be reduced. The Board of Appeal confirms the decision of the Conciliation Board granting ten per cent. extra to night shifts. The employers also appealed the decision of the Board of Conciliation fixing August 20 as the date on which the increased wages should take effect and providing for the revision of rates at the end of six months, if the rate of living is increased. The Board of Appeal considers that the word "increased" should be struck out and replaced by "altered" in order to provide for a reduction in the wage scale if the cost of living should decrease.

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European Events and War Contracts.

THE falling down of the German war machine has come with the earmarks so characteristic to the breaking up of a hard winter. Just now the German war lords are fighting with their backs against the wall, and the appearances indicate that the dynamite is well and carefully laid to blow down the wall.

The world hardly realized what a tower of strength Austria-Hungary had been to Germany until the former quit. Germany was regarded as holding up the dual monarchy, while as a matter of fact Austria-Hungary was the great and effective buffer that kept the Eastern frontiers of Germany immune from attack. That buffer has gone. Turkey has gone absolutely and without a squirm by way of protest. Bulgaria led the procession.

Stripped of her allies, Germany stands alone to face the fury of an aroused and outraged world. If the Hun wills to fight on, then the Hun must have counted the cost and decided to commit national suicide.

The moment the German army came to a standstill it was beaten, for it must be remembered that it was a war of conquest, and not defence, that called the Potsdam war machine to action. The moment the German army got word to retire, that was the beginning of the end, for an army bent on conquest, by its first yard of retirement announces to the world that it has failed in its mission and purpose.

The empire-shattering events that are going on in Europe have their sequel in the commercial and industrial world. They have their touch on the situation in Canada. They reach the machine tool trade, the supply trade, the mechanic and the unskilled employee. They have all to do with the ushering in of that period to which we refer now as reconstruction, the turning from war work to the industries of peaceful days.

Making munitions has been the means of good money for Canadian shops and Canadian mechanics. But Canadian shops and Canadian mechanics do not want to make munitions any longer than the necessity of war calls for them. The turning out of munitions is the carrying on of war, and there is a tragedy, unwritten at the time, in every shell that leaves the lathe, and sorrow and desolation in every bit of shrapnel that passes the inspector. A mechanic may regret the passing of a form of employment that has meant good money to him, but no mechanic worthy of the name of a man could wish the war to continue in order that his employment at good wages might be projected on indefinitely into the future.

The end of war contracts, though it has not come yet, is in sight. It is not going to take the manufacturers by surprise. They have been looking forward to it, and many of them have planned carefully to fit their business relations to the new conditions.

The panic that marked the opening days of the war will not be repeated unless all signs fail and people lose their heads entirely. The population of the world will still need things to eat and to wear; they will need machinery, and they will need buildings. The sun will probably continue to rise in the east and set in the west, and the chances are that the North Star will remain in the north. Folks will probably go to bed at night and get up in the morning as per usual, and the head of the house in this land will sift ashes and crank the furnace as per usual. Don't let the panic idea get into your head. It's not going to come unless you go out and put a rope around its neck and haul it in.

Coal Bins and Church Union.

THE Protestant churches in Brockville held union services last winter. It may have been that they were forced to do this because there was a shortage of coal. Against this, however, is the fact that they are doing it cheerfully on a large scale this winter because they want to do it, and have sent a letter to the Ontario fuel controller pledging support.

This sort of business is liable to do quite a heap of good apart from the coal that will be saved, and that should amount to quite a bit, for the average sexton is a pretty fair stoker when it comes to burning coal.

The Presbyterians may possibly happen to find out that the Methodists are not half bad, and the Methodists may in turn wise up to the fact that the Baptists are not such a poor sort when they get a close-up view of them.

Not only so, but it must be some satisfaction for the pastors to get a chance to preach to a full house now and then. If there's anything that should put a preacher in shape for tremendous action it is a full house. If there's anything that would put the damper on this eloquence and the cold water on his fervor it would be a complement of empty seats. Somehow we've always felt sorry for the pulpiteer who has had to start his day's job with that won't-you-move-up-to-the-front look on his face. He may get off to a good start and keep going right to his "in conclusion," but at the same time he's got a handicap against him that puts him in the class of a lame horse pulling a stone boat.

By all means let the church goers save feul. Let the Baptists sit in tight up against the Methodists, and let the stalwart Presbyterians be sandwiched with the Congregationalists. Nothing will harm them. Let them vie in matching pennies on the collection plate. Let 'em lift their voices higher than the rafters in praise and worship.

If this coal famine keeps up much longer we'll have a real church union. If all these doctrinal hair splitters can live happily together during the cold months of winter, you won't be able to keep them apart during the happy months of the spring and summer.

ADVICE received from a very reliable source at Ottawa intimates that Cabinet reconstruction will take place there within a few days. It is to be hoped that the business interests of the country will be strongly represented. There has been a serious deficiency at the capital in this direction, and it should be remedied. Industrial Canada will need a strong representation to state its case in the after-war problems. It's no job for a weakling, and it's so great a proposition that a little man would hardly dare tackle it.

Some chap in Austria wants to govern the German nation when the Kaiser quits. If he's really in earnest for that job he'd better apply to the Allied custodian of alien enemy property.

Is Power Rationing Needed.

THE insistent cry for more power from the makers of war necessities can be met in only one way. During the coming winter it is hardly to be expected that more power will be available and the only wise and reasonable course is to rightly use that available. Anyone acquainted with the situation existing to-day knows that the munition load, though large, forms but a part of the total power consumption and the curtailing of the energy supplied to makers of household goods, amusement devices, and luxuries of all kinds, would go far towards the releasing of power for the steel plants, abrasive industries, carbide and cyanamide makers, and other industries which make North America dependent in no small degree upon the Niagara district.

This rationing, while just and equitable in itself, would work to the advantage of the country in another and perhaps more tangible form. The labor situation is, to say the least, serious, and any curtailment in the production of non-essentials, automatically releases workers for the vital war industries. People can very well do without pianos, talking machines, and the like for a few months, and can easily purchase them after the war, when their manufacture will help in the necessary readjustment.

The home, too, might well be put on light and power rations. The Tuesday morning ironing bee in the home means an extra 16,000 kilowatt load on one of the Niagara systems alone, and no effort is being made to curtail the sale and use of electric appliances for the home.

Hand in hand with the equitable allotment of the white coal goes the need for more energetic measures for coal conservation. We are to a large extent dependent upon our southern neighbor for our coal, and the least we can do is to use it as efficiently as is being done in the United States. A questionnaire, such as they have sent out to the power plant owner is unheard of in Canada, and the rigid inspection of the individual power plant by government officials evidently has never been thought of. A plant owner faced with the complete stoppage of his coal supply through his own careless ways of burning coal is extremely likely to take an active interest in his boiler room and its equipment. A CO_2 apparatus then is looked upon as a life saver, and other means of checking plant waste likewise.

The Kaiser a Plain Murderer.

WE have been accustomed of late to speak of the prospective surrender of Germany. As far as the German is concerned there should be no terms.

It is quite clear that the Allies do not intend to treat with the Kaiser. What then is to become of him? A kicked-out monarch is too dangerous to be at large. If he is allowed to remain in Germany he will hold to him a retinue of followers who will constitute a hot-bed of plotters against any form of government that would overthrow the German autocracy.

Were the question put to a dozen men, "What would you do with the Kaiser?" the replies would run the gauntlet of excesses.

The German ruler stands right now convicted of murder a million times over. Why should he not face the charge, then, the same as any other individual? If a man kill another in this land he is convicted of murder and is executed.

Why, then, is the murderer of a million any the less a criminal, and worthy of death?

One Grand Old Custom.

OH, things change fast in these here days, they're most peculiar times, and its hard to keep your ways and thoughts from draggin' on the lines. Why, things what was quite new and fresh a day or so ago is set kerchuck inside a day at the bottom of the row.

Why, clothes that wimmen used to wear, the latest thing in style, if we should see 'em nowadays we'd heave a husky smile.

Likewise the men they used to wear chin whiskers on their face, and sproutin' these here ornaments was like unto a race—but nowadays they whack them off and all our young man grows is a tuft about one inch across a-settin' 'neath his nose.

Folks used to get a paper 'bout once or twice a week, and through the columns of the thing both up and down they'd seek—they knew most all that paper said, they was full up with news, and likewise versed upon all stuff like Grit and Tory views. But in this here fast and dizzy age a sheet comes out at dawn, and 'fore the kettle's on at noon the thing is old and gone, and noon editions have a spell, they live for half an hour, but 'round at six they're greeted with a look what's cold and sour.

And youngsters used to learn to play pianers fine and grand, but now they pay their 30 cents for music rolls what's canned.

But there is one old custom, more glorious than the rest, that stays in favor in the north, likewise the east and west—when winter time comes 'round each year 'tis then it thrives for fair, when father slides down cellar and sifts the ashes there.—Ark.

STUDY PROBLEMS THAT WILL COME AT END OF THE WAR

ABOUT forty persons, including representatives from the Canadian Manufacturers' Association, the Canadian Reconstruction Association, and organized labor, were present at the conference at Ottawa last week to consider reconstruction problems after the war. Among those present were Senator Beaubien, Senator Nichols, Major Anthes, James T. Gunn, Sir Alexander Bertram, A. D. Huff, H. P. McNaughton, W. K. George, J. G. Hay, A. H. Brittain, R. Jamieson, George Henderson, Sir John Willison, S. R. Parsons, and a number of others.

The declared object of the delegation was to lay suggestions before the government looking to the formation of a strong committee to cooperate with the government in a definite scheme which would form part of a broad plan of reconstruction after the war, the particular aim of the manufacturers represented on the delegation being the extension of the export trade. Premier Borden said he cordially welcomed the important interests represented and invited them to name a committee to meet with the Reconstruction and Development Committee of the Senate, which has been considering some of the problems referred to. The choosing of the committee was left in the hands of Senator Nichols, and when his work is complete it will be called together in Ottawa to formulate a scheme to put before the government.

After the meeting with the government a further meeting of the delegates was held at the Chateau Laurier, at which they heard some particulars of the Lyon's Sample Fair, which has been held at Lyons, France, for the past three years, and which was instituted to replace the Leipsic Fair.

The first year of the Lyons Fair it was made up largely of French exhibits, the Allied and neutral nations contributing not over ten per cent. of the articles shown. Since then interest has increased greatly, and the percentage of allied and neutral exhibits also. Last year they were thirty per cent. of the total. There was practically nothing from Canada. At the fair which will be held next year a fair amount of space has been secured for Canada, and it is hoped that a fairly good exhibit of a composite character representing the products and produce of the factories and farms of Canada will be shown. The Dominion Government is bearing the cost of transportation of the exhibits from the Canadian seaboard to Lyons, as well as any charges for space at the fair. After the exhibits have been shown at Lyons it is intended that they shall be taken to the fair at Milan, Italy, and from there to London. The amount of business transacted through the Lyons Fair has grown very rapidly. Last year it amounted to one hundred and fifty million dollars.

Getting in Shape for the Coming of Peace

Machine Tool Trade Reports Falling Off of Orders For War Shops —Some Form of After-War Price Control is Looked For—Scrap Prices Are Likely to Drop Soon

EVENTS that are transpiring in Europe are having their effect on the machine tool and supply trade this week. There is nothing surprising in that. In fact the trade is right now going through the successive stages that had been anticipated. There are lines in which it can be said that the passing from war to peace footing has been partially accomplished. Panic talk is not heard. Of course there are industries that are so outstandingly war favorites that they will pass away when peace comes again, but this group is in the minority and is prepared for its fate.

There seems to be a growing feeling that there will be some measure of control in regard to the steel and iron situation after the war has ended. Such a measure would have the effect of lending a desirable stability to a situation that might otherwise be uncertain and panicky. Reports from United States indicate that some form of control will be maintained from Washington while business is getting on a peace footing. The feeling is that with some such body setting the standard of prices it will be a much easier matter to avoid cutting prices to points below cost, and it will allow firms to dispose of their war-price stock without having to go out of business.

The demand for machine tools for war plants is practically at a standstill. Sales of supplies are better but inclined to be spasmodic. Munitions plants are not stocking up with supplies but are buying for actual and immediate needs.

Jobbers are running low on stocks of steel plate. In fact it is hard for them to restock at present, and they are not inclined to do so considering the difficulty that is met with in getting material from United States points. They are satisfied to approach the coming of peace with warehouses as near empty as it is safe to run them.

Machine tool dealers in Canada come under a recent ruling made in United States in regard to "stock" orders. The practice in the trade has been to place orders for machines and then sell them. Now no order can be placed that is not backed by a bona fide sale. This ruling will make it harder for the dealers to do business for the time being, but it will also do much to keep them from facing peace with a lot of single-purpose machinery on their hands, and it will also go a long way in cutting down the avalanche of cancellations that otherwise might follow in the wake of peace being announced.

Scrap dealers are to all intents and purposes out of the market. The prices have not actually slumped yet but every indication points to a moving to a lower plane in the very near future. Scrap metals are now about 85 per cent. above pre-war prices. Copper, for instance, was worth about 14 cents before the war, while now the United States government fixed price is 26c. Scrap prices are likely to come down, and as a result there are many sellers on the market now but few buyers, and sales are made only for special and urgent cases.

LIGHTER VOLUME OF BUSINESS NOTED IN MONTREAL THIS WEEK

Special to CANADIAN MACHINERY

MONTREAL, Nov. 7.—With every day bringing new but not unexpected surprises it is natural to find that industrial conditions are more or less affected. The encouraging news from the front has created a situation that time alone can define. That munitions making activity should be first to feel the reaction of the peace movement is expected, and nervousness is shown in shell-making circles as to the early possibilities in this connection. Despite the restricting influence of the influenza, the subscriptions to the Victory Loan are flowing in regularly, and its importance is clearly shown over all other activities. The markets generally are feeling the inevitable results of peace possibilities, as shown in the lighter volume of future trading. Machine tools are quiet with shell demand almost eliminated. Old material business is almost stagnant from the dealers' standpoint. The metal markets are operating on a normal basis with little of feature to report. Under existing conditions quotations are given as a nominal guide only.

Steel Still Active

Developments in the war situation are tending to unsettle the trade, but this so far has only shown on the surface as activity in all quarters is apparently undiminished. Steel output is still insufficient to meet the requirements of present demand. Some dealers have been hoping for relief in the getting of steel owing to the possible early falling off for war purposes, but little indications of such conditions are shown in the attitude of the War Board as restrictions on the distribution are as firm as ever. Even should peace materialize out of present developments it is not likely that immediate relief would be given to steel consumers unless it be in the direction of heavy steel bars now utilized for shell material. The demands for plate and structural steel will probably continue for an indefinite period, so that a return to pre-war conditions will be a matter of many months, or perhaps years. Another factor that will influence the post-war activity is the retaining of the present boards for the purpose of adjusting, gradually, the existing system to meet the needs of future requirements. The tendency is to ease up on shell production, and this has been reflected in the suspension of new activities in this district. Plants now working on American shells expect to complete their initial contracts but are not antcipating renewal orders. It is understood that some orders for supplies are being placed with cancellation clauses to guard against possible contingencies. Local dealers are still looking to the War Trade Board for their steel requirements, and conditions here are virtually unchanged, with prices, apart from those under direct control, on a nominal basis.

Little Demand for Shell Machines

Despite the quieting effect that approaching peace possibilities have had on the general industrial situation, the enquiries for machine tool equipment are still of fair volume but showing a tendency for domestic tools rather than special machines for shell manufacture. The principal feature in connection with present condition is the falling off in the placements for munitions equipment. Those tools that have been waiting delivery are coming along with fair regularity but little business of a new character is reported. This must be expected in face of the rapid developments that are likely to change the early future prospects as regards war materials. No sudden cessation of shell making is anticipated, but new plants now under consideration, or the placing of new orders, will doubtless be deferred for a period. It is understood that one large contract for the American government that would entail the erection of an entirely new plant, has been held up pending early developments. The general machinery market is quiet, with business relatively light. Prices are likely to ease up early in the new year.

Dullness Still a Feature

Dullness continues to characterize the general scrap situation, and if anything, is more emphasized than last. Few consumers are in the market for large supplies of material, and what business is passing is confined to small lots for jobbing foundries. The mills are taking only what they require for immediate needs and demand for future delivery is practically nil. The situation here might be summed up in the statement of one dealer, that "we are not selling a solitary thing." This of course refers to relatively large sales, some light orders still being placed. The controlling factor appears to be the unsettled condition of the trade as a result of the present European developments. This uncertainty will tend to maintain the present nervousness. Dealers are anticipating a decline in scrap prices, especially in irons and steels, but are holding to the present nominal prices until something turns up on which they can base their further adjustment.

TRADE PASSING FROM WAR BASIS

U. S. Order Re "Stock" Orders Clears The Decks, If It Does Make The Going Harder

TORONTO. — The whole trade, machine tool, supplies, steel, scrap—in fact any industry that has been affected by the making of munitions, watches the situation on the western front, in Austria, Turkey, and every place where the quick-changing last act in the war drama makes more certain the near approach of the time when business will have to be recokened with from the angle of peace-time competitive trade. We say competitive trade because the element of competition in war trade has been largely eliminated.

The idea that there is going to be panic is being discounted by men who are giving a great deal of attention to the matter. They have, in many cases, brought their business affairs to the point where the load is not heavy, and in other cases they have been aided in this by some of the latest regulations that have been put into effect by Washington.

Machine tool supplies are quietier in demand. There has been a falling off in the inquiry for new equipment. The dealers in scrap metals report that they are largely out of the market, because there are more sellers than buyers, and they are overstocked now. But these conditions have been anticipated, and the business executives have not been napping or sleeping at the switch. In many cases the businesses have passed into the first stages that were anticipated following the declaration of peace.

In Machine Tools

Dealers in machine tools can readily see where the war business is falling away. They report no inquiries for new plants during the week, and as yet selling for after-war trade has not commenced in earnest. The action of United States War Industries Board in cancelling "stock orders" for machine tools has cleared the decks as far as a great deal of business handled by Canadian dealers is concerned. There were firms in Canada who some months ago were placing orders heavily in United States against dates as far removed as June 1, 1919. It is probable that in the aggregate this prospective business placed in U. S. shops would amount to many hundreds of thousands of dollars. It has been the best way that the Canadian dealers could book business. They would order the machines first and then proceed to sell them, quite secure in the anticipation that there would be a market for their holdings. It was an easy matter to approach a prospect with the suggestion that you had a machine on order three months back, and that he could get this by securing the necessary priority and license. It was much easier than to approach the customer with the information that you would have to take his order, secure the necessary papers and information, and then go to the makers of such machines and see what could be done in the matter of deliveries. The latest ruling has practically cleared the Canadian houses of anything but real bona fide business. Although it may work out a bit rough in a few cases, it will be a blessing in others, and on the whole will add a degree of stability that could not otherwise be secured. In one way it backs up the policy that has been adopted already by some of the larger firms of "no cancellation." It will tend to give a clear sheet to work on. Had the machine tool manufacturers found their books full of cancellation business on the conclusion of the war they would have been faced with a serious problem, because the cancellations would follow on through a good many shops in which part of the work had been carried on, and there would have been a great deal of readjustment, much of which would not be satisfactory.

The Supply Business

The machine tool supply business may well be described as spasmodic. One week the bookings are good, the next week they are equally bad. Munition firms are not buying supplies at the rate they were a few months ago. There is a very marked tendency to adopt a pretty close policy in this regard. Of course there are shops that have contracts where they know they are well protected against any investment they may make with regard to equipment or supplies, but in the majority of cases the policy of buying well ahead is not being followed in the munitions plants.

The Steel Trade

The day of ten cent. steel is almost done for. That is the opinion of the trade, and the trade is glad of it. Two hundred dollars for a ton of steel is a fictitious price, and it cannot long survive. The jobbers have faced a dangerous situation. There has been a lot of business offering even at ten cents a pound, and dealers have been quite safe in buying at a price that ran around 7½c. The danger came in being overstocked when the time should come to meet the 3¼c. price at the American mills. It has been so difficult to secure material that there has been little chance to stock up very much. Jobbers have let their plate stocks bought at fairly high prices run out almost to the point of exhaustion, and they consider that it is good policy on their part to keep these stocks right there until there is something more definite in the way of new prices. There is a feeling, quite marked too, that the War Trade Board, or some organization of a like character may remain in power for some time following the war, to consider and equalize prices. A statement by Hon. Mr. Ballantyne only a few days ago intimates that there will be a drastic readjustment in the price of plate. The government right now recognises $150 per ton at the mills for plate, while the price arranged for the new mills at Sydney, for ship plate is $83. Small wonder that the dealers are working on the

POINTS IN WEEK'S MARKETING NOTES

Scrap metal dealers state that they are practically out of the market. Prices now are on an average 80 per cent. above pre-war figures, and dealers do not want to be carrying these high value materials when the time comes to sell into a peace time market.

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Machine tool dealers report that there are very few inquiries for new equipment for the turning out of war work.

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Business in supplies for munitions plants is spasmodic. Most of the shops are not carrying much stock, and only place orders for immediate needs.

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Dealers in steel plate believe that the day of 10 cents per pound sales is about over, and in nearly every case the stock has been allowed to reach a low level, so there will be little of this high-priced plate on hand when lower levels are reached.

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The experience of the past week shows that it is harder than ever to secure material for anything but straight war work. A large gas company was refused steel plate for repairs to existing equipment. The same thing happened some months ago, but at that time the company secured statements from many munitions plants stating that gas was essential to them, and the steel material was forthcoming.

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New York reports that there has been a decided falling off in the volume of business for war shops being placed by the United States government this week.

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Pittsburgh believes that the War Industries Board, perhaps in some modified form, will remain in existence for some time to regulate prices at the conclusion of the war.

policy of hand-to-mouth until the situation has been ironed out more satisfactorily.

There is no betterment in the steel supply coming to Canada. A large gas company was refused plate for repair work. Not long ago this same concern was turned down at Washington because the authorities there held that gas plants were not necessary to the production of munitions. The management immediately secured the statements of a number of munitions manufacturers that gas was very essential, whereupon the needed material was secured.

Full Up On Scrap

"For the greater part of last week," stated one of the big dealers, "we were out of the market entirely. We are not keen to buy now. In fact there are lines that we would not purchase at any figure. Our whole premises are loaded to the ceiling, and we will not take on anything else. The whole trend of events and of feeling in the trade points to lower values, although the prices quoted now are nominally correct. The situation is this," he continued, "prices are now too high for commercial business. They are, on an average 85 per cent. above the pre-war figures, and we are not going to buy at war prices and hold to sell into a lower after-war market. Copper and spelter set the pace for the yellows, so brass follows. Copper, as a general thing, is the big end of the scrap metal business, although according to the stocks at the foundries, steel and iron are a close second at times. The average price of copper before the war was around 14 cents per pound, while the price fixed by the United States government at the present time is 26 cents. There are large quantities of scrap offering for sale. We don't want to buy and we may as well make our position definite in the matter."

COMING OF PEACE FELT IN NEW YORK

But Large Orders Are Still Being Placed For War Plants Here

Special to CANADIAN MACHINERY

NEW YORK, Nov. 6th.—The coming of peace with rapid strides undoubtedly creating a conservative feeling throughout the machinery industry but there is a wide difference of opinion in regard to the ultimate effect upon manufacturers. Although the volume of business has been reduced somewhat by expectation of less activity in war preparation, it is notable that important contracts for machine tools continue to be placed by the Government and by war munition plants. Some cancellations of orders previously placed indicate that extensive programs for ordnance will not be carried out as originally intended, yet heavy purchases will be made in the aggregate for some weeks longer.

The Emergency Fleet Corporation has cancelled equipment orders for the proposed Scott boiler plant of the Barber Asphalt Paving Co., at Maurer, New Jersey, and also for tools designed for equipping Government owned shipyards in various stages of completion. Already, steps have been taken to suspend the construction of wooden ships at the Kearny, New Jersey plant operated by the Foundation Co. Before the first of the next year the Foundation Co., will have completed the building of ten Ferris standard type ships at the Government yards built on the property of the Ford Motor Co., but orders for other wooden craft to be built at this plant have been cancelled; large numbers of workers have already been laid off.

From information which CANADIAN MACHINERY received from Ottawa before going to press, there had been no cancellations of munitions contracts made yet. However, the feeling at the capital is that this move will be made in the not distant future, should the situation on the Western front remain as favorable as it is at this writing. Local munitions firms are in much the same position as Ottawa, but in the meantime capacity production is the watchword of the shops.

Purchases of several million dollars worth of hydraulic forging presses have been made by the Government for equipping various munition plants throughout the country to pierce hot ingots for shells. Orders were also placed for the same plant for several hundred thousand dollars worth of pumps and accumulators.

The placing of additional contracts for 4,000,000 semi-steel shells by the Government is also announced and several of the manufacturers receiving these orders are buying machine tools. The Kansas City Hay Press Co., is to make 2,000,000 155-m.m. shells, the Pittsburgh Iron & Steel Foundries Co., Midland, Pa., will make 250,000 8-inch shells and the Kohler Co., Kohler. Wis., will manufacture 200,000 155-m m. shells. The Massey-Harris Co., Batavia, N. Y., has also received a contract for semi-steel shells.

The Singer Manufacturing Co., has made additional large purchases of ma-

WELLAND MAN'S VALVE MEETS WITH BIG SALE IN WAR PLANTS

A. L. CALVERT, 60 Randolph street, Welland, chief engineer of the Canada Forge Company, has invented a hydraulic operating valve which will make his name famous, and if it does not make him rich it will be a wonder.

This valve, which was designed to ease the operation of shell making, was perfected last March, and the first one was installed at the Canada Forge plant. The invention met with an instantaneous success. It was taken up by the Imperial Munitions Board and the Imperial Ordnance Board, as well as the United States Board in charge of munition making.

The result, says the "Welland Telegraph," is that eight firms are engaged to-day in making the Calvert valve.

The selling price of the device is $1,040.

Invention Meets With a Remarkable Reception

Among the Canadian installations are the following: Canada Forge Co., 15; British Forgings, Toronto; the following Montreal firms, Peter Lyall & Son, Fairfax Forging Company, and Dominion Bridge Company; the Goldie McCullough Co., Galt.

Last week 45 valves were installed in the Symmington Forge Company's plant in Rochester, and this week a similarly large installation will take place in a large Chicago plant.

The valve used formerly to operate presses in shell making was packed with leather. This packing had to be replaced every few days, causing a delay of some hours, not only to press, but to the whole unit engaged in the operation. With the increasing cost of leather the leather bills ran into thousands of dollars.

Mr. Calvert set out to perfect a valve that would eliminate the use of leather and advance operating time to one hundred per cent.

Inventor Nearly Floored

He got the idea of the valve and had it completed, but he came to a full stop when he came to devise a plan to connect it up. He worried over this for weeks, until finally he was in very poor health. His doctor told him he was worrying about something, but Mr. Calvert gave no inkling of the secret. One day at dinner the idea of the connection came across him like a flash. In a few days the first valve and connection were completed and installed at the Canada Forge plant. Soon fifteen Calvert valves replaced the ones previously in use. Inspectors for the Imperial Munitions Board saw the valves and what they were doing, and now all the munitions plants are being fitted with them as fast as they can be installed.

First Valve Has Never Lost a Minute

As the first valve was put in operation only on the 15th of March last, the success of Mr. Calvert's invention must be put down as one of the largest successes in the engineering field. That first valve, it is interesting to note, has never been a minute out of commission since it was put in.

The device is very simple in operation. A small lever lets loose a pressure of from 250 to 500 tons as is required.

Mr. Calvert has sold the American manufacturing and selling rights to the Southwark Foundry and Machine Company of Philadelphia, and in Canada the machine is made by the Imperial Manufacturing Company of Welland.

After twelve years with the Canada Forge Company, Mr. Calvert now finds it necessary to devote practically all of his time to the immense business developed by reason of his invention.

chine tools for equipping its Elizabeth, N. J., plant for the production of gun recoil mechanisms. The J. L. Mott Co., Trenton, N. J., that will concentrate on fuse work, has purchased fifteen lathes and other tools. The Symington-Anderson Co., Rochester, N. Y., is adding twenty tools to its gun plant. The Bartlett Hayward Co., Baltimore, and Sprague works of the General Electric Co., at Bloomfield, N. J., that are concentrated on Government work, have been buying supplementary lists of machinery.

The Holt Manufacturing Co., Peoria, Ill., has concluded the purchase of $500,000 worth of tools for the manufacture of caterpillar tractors and the Ordnance Department of the United States Steel Corp., has made additional purchases of machinery for the Neville Island plant, including large gun-boring and turning lathes. Equipment orders thus far placed for this plant call for the expenditure of $10,000,000 and a large number of small and medium size tools are still pending. Buying of machinery for the 16-inch howitzer plant at Nicetown, Pa., however, is held in abeyance awaiting instructions from Washington. Included in the $130,000,000 purchases of motor trucks and similar equipment by the Motor Transport Corps are $12,000,000 worth of class B motor trucks; these latter orders were distributed among seven different manufacturers, including the Republic Motor Truck Co., Alma, Mich., which will build 2,000, and the Denby Motor Truck Co., Detroit, 1,500. The Stutz Motor Co., Indianapolis, has taken an order for 200 artillery tractors.

Large allocations of rails, shell steel, and shapes for the manufacture of 40,000 cars have been made by the Government.

GOVERNMENT CONTROL MAY LAST AFTER PEACE IS SIGNED

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Nov. 6.—Disguise may be attempted, but the great question before the iron and steel trade in the past week has been the matter of prospective prices. Military developments have come rapidly, and it is the cessation of firing, when armistice terms are such as to prevent its resumption, that marks the advent of peace from the business man's viewpoint. In considering the matter of prices, and of control or regulation of business generally, it is important to have clearly in mind the difference between peace from the commercial world's viewpoint and peace from the diplomatic viewpoint. Diplomatically, peace will not come until the President has issued his peace proclamation, which will be many months after the cessation of hostilities. All the war instrumentalities that have been created by authority of law will continue in existence, and doubtless with full legal power, at least to the declaration of peace by Presidential proclamation. The Railroad Administration, the Food Administration and the Fuel Administration, will continue for some time afterwards.

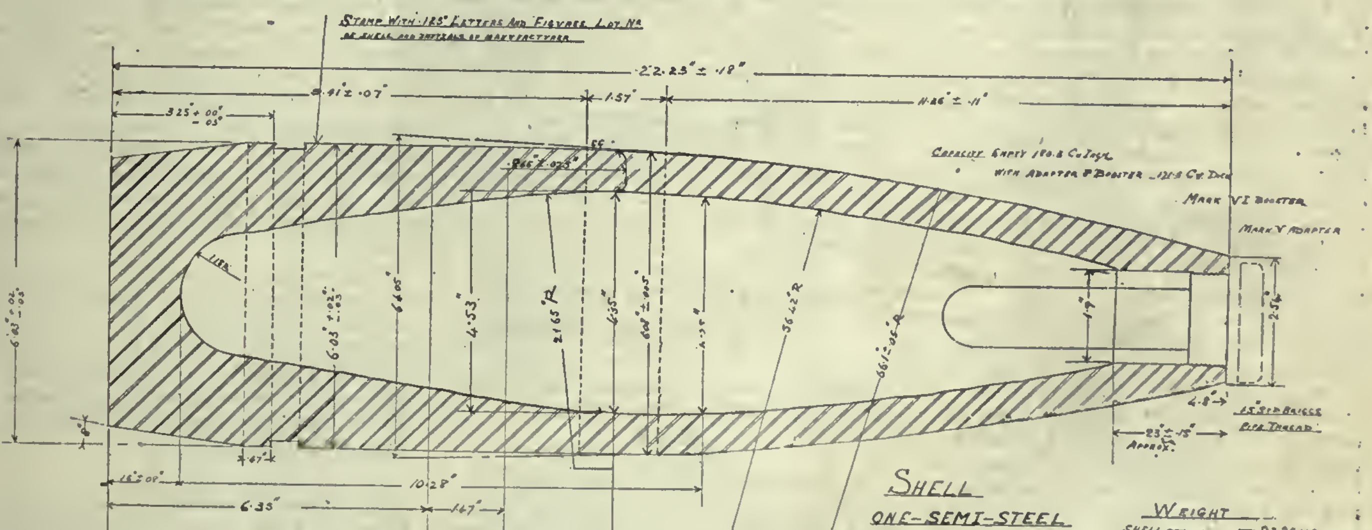
Thus there will be an interim period, from the cessation of hostilities, called "peace" by the business world, to the declaration of peace by the Government. There may be, and probably will be, an interval of several months. Naturally there will be no effort to speed the declaration of peace, but rather the reverse, so as to maintain such war time control of affairs as is desirable.

This separation in the dates of "peace"—commercial and diplomatic—brings to the front the matter of how war time control of industry has been exercised. That which is based on law, like the control of the price of coke, resting upon the Lever Act of August, 1917, the "food, feed and fuel law" is one thing, that which rests upon agreement, like the steel price control, is another thing. The War Industries Board controls steel prices by agreement with the producers. the steel trade has felt strongly all along that control by agreement is better than control by law, and indeed one reason why it accepted control by agreement when it did was because otherwise control by law was in sight, the Pomerene bill being ready for submission to Congress. The matter becomes very awkward, however, at this time, because for war time conditions control was requisite to prevent prices being too high; for the immediate future the steel trade holds control to be desirable to prevent them being too low. It is intimated that the Government agrees. It wants to keep business prosperous for various reasons, one being that it is necessary to collect taxes, and it wishes to avoid a slump or demoralization. Legally, in view of the Sherman law, it is one thing for steel producers to agree not to sell at above certain prices and quite another thing for them to agree not to sell below certain prices.

Government as Buyer

It is hinted that there may be legislation to enable the War Industries Board or some other agency to control

LONGITUDINAL SECTION OF SEMI-STEEL SHELL



Several Canadian shops are figuring on the making of cast shells, and in one case a shop has been started, but that is about as far as the work has prograssed to date. The machining operations much resemble the work on the .155, though of course the work is much more simple. The nose of the gas shell has a longer radius. There are practically no operations on the interior Manufacturers plant to test each shell with hydraulic pressure up to 1,000 pounds, while it is understood that the government test calls for 300 pounds air pressure.

iron and steel prices either way, up or down, but legislation is not always easily secured. There is another contingency, however. In the case of railroad steel and ship steel the Government will continue to be a large buyer, perhaps a larger buyer in these two fields than formerly. If it agrees upon prices that will set a pace. Sherman law or not, steel producers could not be expected to sell to commercial buyers at lower prices than it asked the Government. One could hardly charge that adherence to prices thus approved by the Government constituted an agreement in restraint of trade.

When there is so much confusion, doubt and uncertaintly, there is one clear and important thing to consider in the matter of prospective prices: What will be the Government's attitude as to prices for ship steel and railroad steel? On this subject there is some light. The United States Shipping Board, which controls the Emergency Fleet Corporation, the body that places contracts for ships and controls the shipyards commandeered, has for about three weeks been engaged on a program of revision of the whole operation, the matter being referred to in this correspondence a fortnight ago. There have been developments almost daily. Several contracts for shipyard extensions have been cancelled, also a number of contracts for ships, chiefly wood ships. The spirit in which this has been done has been quite obvious to those familiar with the circumstances, but both Chairman Hurley, of the Shipping Board, and Director General of Shipbuilding Schwab, of the Fleet Corporation, have made official statements which leave no room for doubt. The object is to continue building ships, as many as possible, but to economize, to cut out inefficient operations, which were grasped at when every single ship that could be added promised to be almost invaluable, and at the same time to encourage the building of ships at efficient yards. Mr. Schwab's statement of only a few days ago was that the definite program that had been adopted was to build 15,000,000 tons deadweight, and only 2,500,000 tons, or one-sixth, had thus far been built. The program was to be carried out. This would mean, as the efficient yards speed up still more, that the weekly or monthly tonnage of steel going into shipbuilding would increase for months to come over the present rate.

Thus there is assured a very heavy demand from the Government for ship steel, but obviously a part of the program already well considered is that of getting the steel at the lowest possible price. As already reported, contracts have lately been offered to steel mills with a new clause, allowing the Government to cancel at will. Clearly the object is to seek a lower price whenever circumstances permit.

As to railroad steel the case is equally clear. Long ago prices on all important steel commodities were fixed, with one prominent exception, standard section steel rails. Last September the War Industries Board agreed with the rail mills on prices of $55 for Bessemer and $57 for open-hearth rails, but the Railroad Administration withheld its approval. Of course, it is now more disposed than ever to seek a lower price. Another important fact is that some of the railroads have refused to accept, and pay for freight cars ordered by the Railroad Administration several months ago, its total distribution being 100,000 cars. The railroads that object assert that the prices are too high and they may not need the cars anyhow. They urged the Railroad Administration to pay for the cars out of the "revolving fund" of $500,000,000 provided by Congress for various purposes, and then sell the cars to the roads after the war at what would then be a fair price. Thus one has both the Railroad Administration and some of the individual railroads plainly opposed to the present steel prices, and their attitude assumed before the cessation of hostilities came so clearly in sight. Now, of course, they are necessarily still more strongly opposed.

Thus we have it that the two great fields in which the Government will remain a buyer of steel after the cessation of hostilities, and for quite a period, there is clearly going to be a move for materially lower steel prices. In all the present uncertainty this is something concrete. One cannot attempt to predict how steel prices will range during the period of readjustment from a war time to a peace time basis, but one of the distinct possibilities is that it will be a sort of "waiting market" for the Government to take the lead in developing new prices for ship steel and railroad steel.

As to the present attitude of the steel buying public, that is quite clearly disclosed. All the regulations of the War Industries Board remain in force, of course, but the restrictions have always related to the manufacture and delivery of steel, not its purchase and sale. One is permitted to buy and sell all the steel he likes, as "Class D," which is steel that may be made and delivered after priorities and preferences are provided for (not necessarily filled) so if buyers were eager to get steel without knowing the prospective price, they would be eager to place orders. This is not the case. They are not even enquiring.

CONTRACTS TO BE FOR MORE VESSELS

Outline Given By Minister of Marine Regarding The Future Work

In pursuance of the Government's efforts to establish a Canadian mercantile fleet, the Minister of Marine has now given out contracts for the construction of 31 vessels. These are all steel steamers, varying in tonnage from 3,400 tons to 8,100 tons deadweight capacity. They are of the one deck and two deck type. It is also the intention of the Government to construct a larger class of vessel, reaching a deadweight capacity of 10,500 tons. The vessels will all be built to the highest class of Lloyd's or the British Corporation, and to the requirements of the British Board of Trade, and Canadian Steamship Inspection Board.

There has been some delay in making a start with these vessels, but it has been entirely due to the fact that the building berths were occupied by vessels building to the order of the Imperial Munitions Board. However, these ships are in many cases vacating the ways, and the Government vessels will be laid down as fast as there is available building space. The contracts have been distributed to yards in all parts of the country, though of course, the size that can be built by the lake shipyards is limited to the capacity of the canals.

It is expected that Messrs. Canadian Vickers, Montreal, will be the first yard to launch any of these ships, as they expect to put two vessels, one of 4,300 tons, and one of 8,100 tons, into the water during November. They will be named respectively Canadian Voyageur and Canadian Pioneer, and will have as sponsors Sir Robert and Lady Borden. If all goes well after launching, it is probable that these two ships will leave the St. Lawrence before the close of navigation. During the winter, if deliveries of steel continue satisfactorily, work will have been far enough advanced to have seven or eight vessels ready for service early in the spring, while the whole of the 175,000 tons comprised in the 31 vessels, will be sailing before the end of next year.

Such is the demand for shipping that if it was desirable the Government could dispose of the vessels contracted for at a handsome profit, but such is not their intention. Being now in possession of a national railway system of considerable dimensions, the Minister stated it was the intention of the Government to keep these vessels for the Canadian people, and work them in conjunction with the national railway system. In this connection the railways will feed the ships on their eastern voyages, while the ships will feed the railways on the return voyage. The management of the steamers will be under D. B. Hanna and his staff, and will not be subject to any interference outside of the management itself.

This combination of rail and vessel transportation has worked out very successfully under private management, and if the same success can be achieved with a national venture, it will go a long way to encourage the partisans of Government ownership. However, we must wait and see.

Appointed Director.—At a special meeting of the board of directors of the Independent Pneumatic Tool Company, held in Chicago on Wednesday, October 30, Roger C. Sullivan was appointed a director and elected chairman of the board, also a member of the executive committee, to fill the vacancies caused by the death of the late John P. Hopkins.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 31 00	$ 29 50
Electro copper	31 00	29 50
Castings, copper	30 50	28 50
Tin	90 00	95 00
Spelter	10 50	11 00
Lead	10 50	10 00
Antimony	15 00	18 00
Aluminum	46 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 37

	Black	Galvanized
Standard Buttweld	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12.41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19
Standard Lapweld		
2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
1½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	30 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd., brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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.	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B. ⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17½
Grand	19¾	Ideal	17½
Superior	19¾	X press	16
X L C R	18½		

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	...
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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EDITORIAL CONTENTS

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

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Practical System in Factory Operations

It is Necessary to Know Costs by a System That Can Give You Figures at Short Notice—Charts Tell a Story That May Have Its Sequel in Many Other Plants

By M. H. POTTER

A STUDY of all the conditions holding in the old plant must be made before the factory can be placed on a paying basis. A good many make the mistake of starting at once to reorganize one department or one branch without considering each department's relation to all the others and to the parent trunk.

The first step in straightening out the tangle in this factory was to investigate all the conditions. After spending about three weeks investigating these conditions a general plan of reorganization was laid out on paper. The duties of the various persons connected with the heads of the departments were charted, and then, with the whole plan in view the organization was rearranged along the lines shown in Chart 1.

The purchasing agent seemed to have his hands full; he was unable to give proper attention to any one subject. He had some duties in common with other heads of departments. And as the manager of the factory was present only a comparatively short time during the day a great many things were allowed to pass unnoticed. Such a subject as the maintenance of the plant and equipment.

The same men were retained, but the duties and responsibilities of each one were diagrammed so that no misunderstanding could exist. After the whole plan had been thoroughly considered and worked out, blue prints of this chart were made and distributed to each department in the factory. This method of distributing information in the factory was followed by putting any part of the new plan into effect. The head of each department received a bound copy of the methods decided upon so that he could understand exactly his relation to all the other departments and to the work of which he was in charge.

When putting such a plan into effect the hearty co-operation of each individual, which is essential, can be secured by making it of pecuniary advantage to follow out the plans as laid down. The men in charge of departments naturally consider that the plans upon which they were operating are good and do not take

NAME OF FIRM
Requisition to Purchase — Purchase Order No ____
To Purchaser.- Please Order The Following:-

Date of Requisition	
From. Deliver to. Stores	
Charge to	
When Needed	
O.K	Purchasers O.K
Date Ordered	
In Stores	
Received in Good Condition by ____	Date ____

FORM 1

NAME OF FIRM
Purchasing Dept. — Date ____
Per your request we are making the following quotations.

Quantity	Article	List	Disct.	Net.

F.O.B ____
Goods Received ____ By ____
All bids and quotations to be considered should be made on this card.

FORM 2

Order Form. NAME OF FIRM.
Ship By ____
F.O.B ____ Mark Shipment
Terms ____ Invoice and B/L ____

For	Quantity	Desc of Material	Price

FORM 3

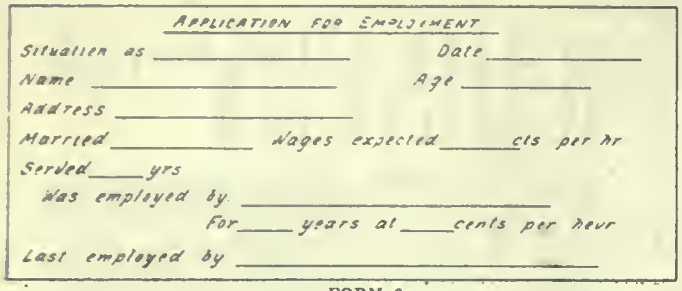
RECEIVING REPORT
Received From ____
Address ____ Date ____

Via ____	Charges ____	Weight ____
Packages ____	Condition ____	
Recd By ____	Chkd By ____	Counted By ____
Disposition		

FORM 4

REQUISITION FOR HELP.
For Dept ____ Date ____
Kind of Help Wanted ____ Married / Single } Preferred
Age Required ____
Remarks.

FORM 5


APPLICATION FOR EMPLOYMENT

Situation as ______ Date ______

Name ______ Age ______

Address ______

Married ______ Wages expected ______ cts per hr

Served ______ yrs

Was employed by ______

For ______ years at ______ cents per hour

Last employed by ______

FORM 6

EMPLOYMENT CHART	Helpers	Boring Mch	Millers	Machs.	Lathe.	Optrs
Lumber Yard Dry Kiln						
Mch Dept						
Bending Dept						
Forge Dept						
Millwright						
Stores						

CHART 3

very kindly to new burdens imposed upon them by a reorganization or by the rearrangement of the work formerly handled in their departments. By paying a bonus on daily production the department changes in routine, however, may often be accomplished successfully. After it is explained to the man that he can make more by working out the plan proposed he is not long in deciding that the new plan is at least worth trying out

After a general plan of organization has been developed the second step is to arrange the methods used from the buying of the raw material to the shipping of the product. An easy way to do this is to take some one particular product and trace its course from start to finish through the plant, putting all the different steps down on paper so that the actual routine used in the factory can be seen graphically. After this has been done it will be found that the purchasing and stores department is a starting point for reorganization.

So in reorganizing the factory the start is made with the requisition blank. As no regular system of buying had been in use in the factory the purchasing and stores departments were replanned. When it was necessary for any raw materials, supplies or tools to be purchased it was arranged so that the department head requiring the material was to make out a requisition called a "requisition to purchase" (Form 1). This was sent from the department head to the superintendent for approval. If the cost was considerable this requisition had also to have the approval of the factory manager, and in cases where purchases amounted to over one hundred dollars the general manager of the plant O.K.'d the requisition. The requisition thus O.K.'d was given to the purchasing agent and constituted his authority for making the purchase.

If the item was something which the purchasing agent had no quotations of on hand, a "request for quotation" card (Form 2) was sent to the firm or firms handling the goods required. They had only to fill in the price, sign and return the card. These cards were made standard size so that they could be filed conveniently in the indexed drawer and kept as a basis for price on future orders. After the cards were returned a clerk entered the prices upon a quotation record card for general reference.

When a purchase was to be made the order was sent out on a sheet like that shown in Form 3. Three copies were made, the original going to the supplier. The first copy was kept by the purchasing agent and the third sent to the storekeeper. The latter checks off the receipts on his copy from the receiving report (Form 4).

It had been customary in the plant to call the factory manager, superintendent, or foreman whenever an applicant for employment presented himself. The request for an interview was usually made to the telephone operator, whose desk was near the office entrance. Since she was desirous of pleasing everybody and aiding her friends, the operator would immediately create confusion in the whole plant, if necessary, in her somewhat over-zealous endeavor to locate the department heads.

This plan of hiring men was abandoned. The accounting department was housed in the adjoining room to the entrance as is shown by the office arrangement (Chart 2). The location of the timekeeper was changed and a window was cut in the partition at his back. How the office was rearranged is also made clear. Just above the window was

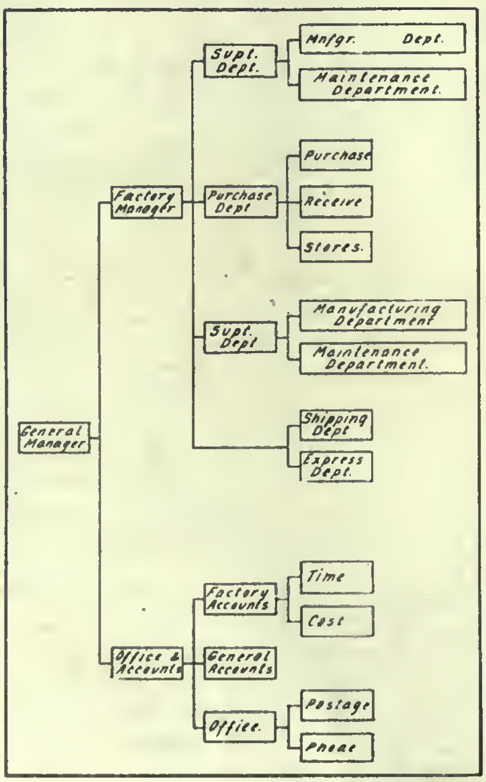


CHART 1

mounted a blue print (Chart 3). This chart was called the "employment chart" and the timekeeper could tell at a glance just what class of employees were in demand throughout the various departments. The employment department was

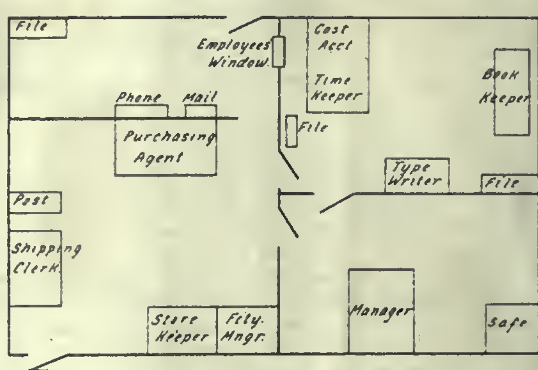


CHART 2

turned over to the timekeeper. Each department head would issue a "requisition for help" (Form 5) when in need of help of any kind. One of these requisitions was issued for each person desired. Upon receipt of these the timekeeper would place a peg or glass-headed push-pin in one of the squares opposite both the department and the class of employees.

When an applicant presented himself it was a very simple matter to tell whether or not he was needed. If not, he was requested to fill out an application as shown by Form 6, providing the timekeeper thought that the company would ever care to engage him.

SPONTANEOUS COMBUSTION OF COAL

It has been shown by experiment that the sulphur contained in coal in the form of pyrites is not the chief source of spontaneous combustion, as was formerly supposed, but the oxidation of the sulphur in the coal may assist in breaking up the lumps of coal, and this may increase the amount of fine coal, which is particularly liable to rapid oxidation. Even this opinion is not unanimously endorsed. In spite of experimental data showing that sulphur is not the determining element in spontaneous combustion, the opinion is widespread, if possible, it is well for storage purposes to choose a coal with a low sulphur content.—M. E.

The Employment of the Returned Soldier

The Following Article Gives an Interesting Resume of This Problem as Viewed by an English Correspondent of the Engineering Supplement of the London Times

WITH the manhood of the whole nation in arms so far as it is of military age, the reintroduction of the nation's soldiers into industry will be a far-reaching problem. It will, indeed, not arise for solution until the war is over, but then there will be no time for working out plans to ensure that this indispensable process will be done thoroughly and efficiently. In the interest both of production and of the producers, the plans for assuring this will need to have been matured before the time arises for putting them into operation, and there will be no industry that will not, in greater or less measure, have to be prepared with its programme.

But in the meantime the employment of discharged soldiers includes an instant problem, which has now been long before manufacturing industry, and is daily increasing in volume—the problem of employing men from the Services who are discharged through being no longer fit for military duty. The engineering trades in particular, which are for the time being the backbone of British industry and the most certain source of employment, are badly affected by this problem, and the methods by which it may be solved are all the more interesting because of the somewhat similar problem on a vaster scale which these trades will have to face when the war is over.

Kinds of Disability

Men may be discharged from the Services for various reasons. The typical case is, of course, that of men who have lost one or more limbs or eyesight. No class of workers can more deserve attention; and it is satisfactory to note that no class appears to be more in the way of getting it. It may perhaps be too early to say how far the great ingenuity that has been spent on devising mechanical means for replacing lost limbs has arrived at the best mechanical solution of the problems it has had to consider. By this time many solutions are under practical trial on the persons of large numbers of returned soldiers; and, in the light of their experience, it should be possible to arrive at something like standard designs, embodying what experience on the unhappily large scale now available may suggest as the best. When this has been done, it will be no less urgently necessary to make arrangements for producing the artificial limbs at a reasonable cost. For the time being cost is doubtless a matter of secondary consequence compared with the importance of giving soldiers who need artificial limbs the best that can be produced with the least possible delay. Once, however, the emergency call is satisfied, the economical aspect will resume its ordinary importance, and it will be the business of those who are in charge of the provisions for supplying artificial limbs to see that the industry is placed on a sound footing in respect of economical production. There is reason to hope that both for discharged Service men who are maimed and for those who have lost their eyesight, enough attention is being paid by enlightened men to make sure that the essential requirements of the situation will be fully met.

Unmutilated Men

It must be remembered, however, that of men discharged from the Services, only a small fraction have suffered mutilation. A large majority have their sight and members unimpaired, and of these a good proportion retain full muscular strength, for either all or many industrial purposes. While, therefore, an essential part of the provision for employing discharged soldiers must lie in finding work that can be done by those whose physical powers are impaired, the problem includes, and consists to even a larger extent for dealing with those who have been released without these disabilities—cases of shell-shock, gas-poisoning, wounds which though they incapacitate men for the violent activities of war, leave them essentially as good as ever for most purposes of the workshop. Such men constitute the large majority of those who have to be reinstated in industry. The figures are not available for showing precisely how many are coming in month by month, but no doubt exists that they are considerable, and are increasing. At the present time most branches of engineering industry are suffering from shortage of labor, and nothing could be more helpful to the engineering trades in discharging their present great duty to the nation than that they should have and make use of a full supply of discharged Service men. Nor, on the other hand, could there be anything more helpful to the men than that they should be introduced into industry at a time when it is most in need of them, and when no economical reason exists for subjecting them to any form of competition such as they will have inevitably to face in ordinary times.

It is, therefore, of great importance both to the work and the workers to consider what may be learned from such experience as has been collected up to now. Engineers have not forgotten that discharged soldiers as a class did not prove satisfactory when it was sought to introduce them into industry at the end of the Boer War. Some of those who have been introduced lately have undoubtedly done better; but evidence from all parts of the country concurs in showing that, as a whole, the services of discharged service men have not been as successful in the shops as it had been hoped they would be.

Industrial Training

It is best to admit the fact plainly, because beyond any doubt a remedy has to be found for it. Whatever circumstances may impede the satisfactory amalgamation of the fraction of the armies now returning with the industries that should receive them will apply no less to the great bulk when they return at the end of the war. If the disappointments and difficulties that are now met with are glossed over or ignored, they will be left to impede much larger operations later on. If they are faced plainly and intelligently, not only may a solution be found for those for whom it is wanted at present, but their more numerous comrades may benefit by it later on.

The complaints that are received do not seem for the most part to show that discharged service men do not find any special difficulty in acquiring the necessary mechanical skill. One of the results demonstrated by experience of war manufacturing has been the extraordinary rapidity with which women can acquire a useful amount of skill—an amount insufficient. indeed, to constitute a skilled all-round tradesman, but emply sufficient to do what is required in a very large part of a properly subdivided manufacture. This experience is getting more and more a matter of common knowledge, though even now it is far from being recognized as widely as it might be. As yet, however, it does not appear to have been applied very completely in the introduction of discharged service men into industry. It has perhaps not been recognized so generally that there is no necessary reason why women should be more amenable to the intensive training by which these results are produced than men would be if they were trained in this way, and not left to the happy-go-lucky methods of trial and error by which lads pick up their trades in workshops.

There is accordingly no reason at all why discharged service men should not rapidly—that is to say, in anything from a month to two, three, or six months, according to the complexity of the craft that they are set to acquire—reach a standard of skill that is fully equal to what would be required of them in a well-organized factory. On the whole, experience seems to show that when they have ben properly trained they give fully as good results as women—results that are quite up to anything that a shop can require. What seems to be more generally lacking is the discipline of industrial life—the habit of keeping time, sticking to a job, and accepting industrial work as a contending vocation.

Factory Life

Nothing can be less surprising than this result. A soldier's life is regulated by discipline; but whether he is fighting or in reserve the discipline is entirely different from that by which men are made contented and efficient in industrial life. When a soldier is in the front lines some forms of routine discipline are greatly relaxed. The life is an alternation. It includes epochs of the severest strain, in which all circumstances combine to force men for an evident common purpose into the attitude their chiefs desire. In the intervals between these epochs of strain are periods of inevitable monotony, during which discipline, though inexorable in essential particulars, occupies a relatively small part of a man's attention. When he is in reserve a well proved and judicious artificial discipline engages practically the whole of his time; but this discipline is so shaped as not only to keep him busy but to keep him interested and amused. It would in any case be out of place for civilians to criticize methods of military discipline; but it is permissible to refer to the fact, now practcally of common knowledge among all who have followed the fortunes of men at the front with any intelligent interest, that the virtue of this apparently artificial discipline has been verified by the most conspicuous success.

When a man comes into a works discipline is no less necessary for the purpose there in view than it is in the army, but both the purpose and the methods are different. The sanction of extreme danger to a corporate body, of which each man is a member, no longer exists. The discipline is no greater at one time than another, but must extend uniformly throughout the day and the year if the work is to be done efficiently. To those who have found a technical interest in their work it may not be monotonous, but those who have not are left for the most part to get contented with their new life as best they can. They are introduced into this new situation fresh from the very different life they had led, conscious that they at least have deserved well of their country, disposed perhaps to expect a special consideration and a softening of their job not permitted by works conditions. What can be more natural than that a considerable proportion of them should become discontented? And what contenting result can be hoped for from discontented men, particularly when the ground of their discontent is a sense, whether well founded or not, that they are being treated with less than justice or with ingratitude?

The Need for Interest

It is idle for manufacturers to imagine that difficulties such as these will right themselves, and still less is it either wise or fair that the returned soldier should be pitchforked into industry to accommodate himself to the conditions of factory life as best he can, and to take the consequence in the form of exclusion if he should fail to do so, leaving out of account altogether considerations of public duty, of which nevertheless engineers are fully as sensible as any other body of men. Again, to leave soldiers to accommodate themselves to works life if they can, or to take themselves off if they cannot, would not only be unfair to the men, but would deprive industry of what should be a valuable means of production. It is more prudent as well as more decent to consider by what means military training has got such brilliant results out of the same men as are found unsatisfactory in industrial life; and when military methods are contrasted with those of industry, the chief difference will as a rule be found to lie on one hand in the absence of corporate spirit by which men should be attached to their works, and on the other hand, in the absence of means for keeping men interested and amused, which are an essential part of the discipline of military life for soldiers not actually engaged in fighting. It may be said that to attend to such matters is outside the scope of manufacturing—that either it is the business of philanthropists, or that men should be able to attend to such matters for themselves. It is needless to discuss whether this contention has any merits. The question has to be settled by much more practical considerations. Those who take the trouble to apply the arts that underlie military training to the care of men engaged in industry will have a body of co-operating workers, and given good management, such a body will be more efficient than groups of men who are not so treated. The works, therefore, that adopt these methods will have an advantage over those who do not; and in times that are coming no works can afford to dispense with any such advantage.

Position of Employers

Civil industry would, of course, fail if it aspired to the methods of control that are used by military authorities. Not only would such methods be unacceptable to workers, but it is more than doubtful whether, even if they were accepted, they would prove efficient for civil purposes. Where the military example should serve as an object lesson to employers is in the care that it takes to keep men interested, and in the extent to which it can count on their corporate spirit. The first condition for a man being interested in his work is that he shall know the difference between doing it right and doing it wrong. Where there is any chance that the work to which a discharged soldier is to be put may be done wrong, it is asking for trouble to put him straight to it among a body of men who are doing it right, and trust to luck that he will pick up the knack. Sometimes he may do so; sometimes his new mates may help him; but often, as repeated experience has shown, the men with whom he may fall into relations will not be those who are the keenest on doing the work right, and his attention will be attracted more to the inconveniences with which he has to put up than to the initiative in marked advanced of selling work which he is conscious of doing only indifferently.

The first condition, that discharged soldiers should have a reasonable assurance of being interested in their work, is that, either in the works itself or in some preliminary training school or instructional factory, they shall be grouped with other men in like position and be shown how to do the work right and how to extract from it all the technical interest that it can yield. While a man is learning thus he will need more personal attention and encouragement than the ordinary routine of most works can spare. At the same time some influence beyond what an ordinary works atmosphere will exercise on a newcomer will be required to help him into habits of punctuality and continuous attention. Some works who adopt no such means find that a majority of the discharged soldiers whom they take on do not stop at their work, but that those who do stick to it for three months remain permanently and do well. Probably a much higher proportion could be trusted to see the thing through if they had a reasonable introduction or re-education in industrial life, given under conditions that include the necessary personal attention and encouragement.

It must, however, be remembered that men vary individually in the work which suits them and which they can do best. A man himself cannot be certain that he will select his occupation suitably, when he has yet to learn and become accustomed to its details; and though experience may do much to cultivate in an instructor the intuition that selects correctly the work for each man, the wisest instructor cannot always be right. The latitude that can wisely be shown discharged soldiers, if the best use is to be made of their services in their own interest and that of industry, should therefore include the choice of a second class of work, should the first not have been suitably chosen.

Team Work

When, however, the initial difficulties have been overcome there remains a wide scope for trying to induce into civil industry the corporate co-operation that is found in military units. What is wanted is not that men should learn either to be eloquent themselves on the rights or wrongs of classes, or—the more frequent case—to sit under other men whose chief stock-in-trade lies in such eloquence, but that they shall be actively practising co-operation as charity should be practised, beginning with their own industrial homes. The purpose of a works is co-operation to a useful industrial end. The more fully that end is attained the better the works, and in any well-managed works the better for each worker. The common experience shows that that co-operation is never so keen and active as when it is promoted by immediate competition. In those works that are large enough to have separate units a wide field is open for stimulating interest by promoting competition between shops or other groups of men within the works.

Two-Ton Electric Furnace Makes Alloys

Heroult Furnace Used For Non-ferrous Alloys—Description of Plant and Equipment

An electric furnace, whose main product is nichrome, the well-known high-temperature resisting alloy, has recently been installed at the plant of the Driver-Harris Co., Harrison, N.J. The furnace is of special interest because of its electrical equipment, which is an excellent example of modern practice. Alloys of various characters are also manufactured by the furnace. It is of the Heroult Arc type, featured with automatic regulation, and has a capacity of two tons.

The amount of power taken at the start of the heat is small, but as the resistance of the furnace circuit decreases, owing to the heating up of the electrodes and the consolidation of the charge, the power consumption rapidly increases until stable conditions are reached. The average amount of power consumed is then held practically constant by the automatic regulator, with the exception of a slight continuous increase, due probably to a corresponding decrease in the resistance of the furnace circuit.

There is, however, no uniformity in the actual power consumption. As the charge melts down, pieces of metal fall between the electrodes and establish short circuits. For the most part these short circuits are only momentary as the fragments causing them are promptly melted down, but occasionally they persist, and then the automatic regulator draws up the electrodes until they are clear. This process sometimes breaks the arc and then there is a sudden decrease in the power consumption until the regulator brings the electrodes down again and re-establishes the arc. As would be expected steel alloys show more of these irregularities than the softer nichrome.

Towards the end of the run there is a marked change in the power consumption when the metal is given a special treatment before pouring. In the case of the nickel steel a higher temperature was necessary, perhaps to lower the carbon contents, while with nichrome the temperature was lowered. The temperature of the furnace averages about 2,200° Fahr.

The high momentary overloads are characteristic of electric furnace work and make it very different from ordinary power service. They must be taken into account in designing the electrical equipment for the furnace, and some of the apparatus must be specially designed to withstand them, as shown in the following description of the Driver-Harris installation.

Power for this furnace is furnished in the form of two-phase, 60-cycle, 2,200-volt current from the lines of the Public Service Electric Co. In the high tension lines are a disconnecting switch and an oil circuit breaker. This latter is used to control the circuit. It can be operated manually and is also provided with low-voltage and overload protection. In order to prevent its operation on momentary overloads, the overload trip is controlled by relays with definite inverse time-limit action. The high tension apparatus and the transformers are contained in a brick compartment behind the furnace.

There are two 400-kva., 2,200 110-volt transformers of the oil-insulated self-cooled type. They are Scott-connected so that they change the high-voltage two-phase current into low-voltage three-phase current, one phase for each of the three electrodes of the furnace.

Special construction is necessary to withstand the overloads. These overloads are of such short duration that their heating effect is negligible, but they tend to force the coils apart. Hence the coils are very firmly braced and are in fact capable of withstanding momentary overloads fifteen times greater than the normal load.

The reactance of these transformers is about double that of ordinary power transformers of the same size. This re-

FURNACE DURING MELT

THURY REGULATORS, RHEOSTATS AND CONTROLLERS

FILLING THE LADLE

2-TON HEROULT FURNACE

REAR VIEW OF FURNACE SHOWING WINCH MECHANISM

INCOMING LINE AND OIL SWITCH

actance together with that developed in the low tension leads (which are made as short as possible in order to keep this factor low) prevents the current flowing through the furnace from exceeding five or six times normal values even on dead short circuits. The voltage regulation is from 106 volts on no load to about 100 volts on full load, and the power factor is from 85 to 90 per cent.

One of the most interesting features of the equipment is the Thury regulator, which automatically maintains an approximately constant current at the furnace electrodes. Without this device the current consumption would vary erratically even if an operator were constantly endeavoring to correct the variations. It therefore saves labor and current, reduces to a minimum the time required to prepare a charge, and by providing uniform conditions keeps the quality of the product uniform.

Each furnace electrode has a separate regulating mechanism and a raising and lowering motor. The regulator can be set for any desired current value, and when this value is exceeded each regulating mchanism closes a contact momentarily, which causes the motors to raise the electrodes slightly. The contacts continue to close at brief intervals until the electrodes are drawn up high enough to reduce the current to the predetermined value, the intermittent action being employed to prevent the electrodes from being raised too high and thus causing an unstable condition. When the current falls below the predetermined value the electrodes are lowered in a similar manner. The regulator itself is controlled by a solenoid energized by means of current from series transformers in the main high-tension circuit. Damping devices prevent the regulator from acting on overloads that immediately correct themselves.

In addition to the automatic device, each electrode motor has a drum controller for manual operation.

The electrode motors are direct-current machines, because alternating current motors cannot be controlled with sufficient delicacy. The operating current is obtained from a 4½ kw. motor-generator set located in the transformer compartment. The motors are 2 h.p. capacity and are totally enclosed. They are provided with grease-cup lubrication instead of the ordinary ring-oiling sys-

POURING THE INGOTS

FURNACE IN TILTED POSITION

WESTINGHOUSE TRANSFORMER MOUNTED ON PEDESTAL TO SHORTEN LENGTH OF SECONDARY LEADS. BELOW: MOTOR GENERATOR SET FOR CONTROL MECHANISM

TILTING MECHANISM AND COUNTERWEIGHT SHAFT. WESTINGHOUSE MOTOR USED

tem so that the lubrication is not interfered with when the furnace is tilted for pouring.

An instrument board is located beside the regulators and carries the following apparatus: A kilowatt meter; a volt meter; a power factor meter; an ammeter for each phase; a graphic wattmeter; a plug switch for reading the voltage of each phase, both across the arc and across the low-tension leads outside the furnace; the operating handle of the high-tension circuit breaker; the inverse-time-element relays for the circuit breaker, and an integrating kilowatt-hour meter.

On the other side of the regulator is mounted a small panel carrying the switches and meters for the motor-generator set, below which is the motor auto-starter.

When the charge is finished the whole furnace is tilted bodily for pouring. This tilting is effected by an 11-h.p. alternating-current slipring motor located in a pit beneath the furnace and geared to the tilting mechanism. It is controlled by a drum controller by the side of the furnace.

The regulating, tilting and control equipment was supplied by the Westinghouse Co.

The Montreal General Tool Co., of Montreal, expect to secure a contract for one hundred marine pumps, the value of which will approximate $300,000.

STOKER MANUFACTURERS' ASSOCIATION

At a meeting in Cleveland on August 1, 1918, an association was formed of the stoker manufacturers of the United States. The principal reason for getting together was to place at the disposal of the government the entire facilities of the stoker industry to the end that everything possible might be done to help out in the national emergency. Even after the war, however, it is expected that great benefit will be obtained by the association members in the discussion of subjects of interest and value to the stoker industry; in the advancement and improvement of that industry; in the standardization of stoker manufacture and application, and in the promotion of a spirit of co-operation among its members for improved production and increased application of stokers. Practically all of the builders of mechanical stokers are included as charter members of the association.

At the first meeting the following officers and executive committee were elected: President, P. Albert Poppenhusen, Chicago, Ill.; vice-president, S. L. Nicholson, E. Pittsburg, Pa.; secretary-treasurer, Fred H. Daniels, Worcester, Mass.; William F. Sauter, Philadelphia, Pa.; W. H. Rea, Detroit, Mich.

The Stoker Manufacturers' Association has been informed that it has been formally elected to membership in the Chamber of Commerce of the United States. A national councillor will be appointed by the association to represent it in the National Chamber, and through this national councillor the association will have an opportunity of expressing itself on national questions under discussion by the federal authorities.

The association, through its War Service Committee, has tendered to the federal government the entire resources and service of its members, and the committee is working with the Fuel Administration and the War Industries Board for the conservation of fuel, labor and raw materials. The association is prepared to do any and everything which may be necessary to prove that American business is ready to back up the government until victory is assured.

OBITUARY

Mr. Frank Davey, superintendent of the Lyall Shipyards, Vancouver, died last week after a short illness. Mr. Davey, who was born in Hamilton, O., went to the coast ten years ago and entered the employ of Mr. Andrew Wallace, who was then starting the Vancouver yards. He remained with the Wallace Company until the Bewicke Avenue yard was transferred to the William Lyall Shipbuilding Co., when he was appointed superintendent for that firm. He held this position up to the time of his death.

Educational Value of Munitions in Canada

Mechanics Who Used to Measure an Inch Into Eight Parts For Fine Work Now on Speaking Terms With Some of the Finest Dimensions in the Trade

By J. N. ROBINSON

SHORTLY after war broke out it was suggested that Canadian factories manufacture munitions. The idea was scouted by most of the manufacturers. They claimed it was an impossibility to handle this fine work with the class of labor and machinery obtainable in Canada. However, some few were bolder, and with the advice of the Imperial authorities, and with the wonderful driving power and enthusiasm of the Minister of Militia, Sir Sam Hughes, behind them, they embarked on the enterprise.

What their troubles and difficulties were during the year of 1915 will never be realized. But the biggest obstacles were gradually overcome and to-day Canada's shell plants compare favorably with any others in the world.

We have re-built old machinery to our needs, and we have built new. But greatest of all we have trained men and women to handle the fine work necessary in making shells. It ordinarily takes from three to five or seven years for a man to work out his apprenticeship in any of the mechanical trades. But here in Canada we had to take men who hardly knew there was a measurement smaller than one-eighth of an inch, and women who measured things by the yard or by the length of their fingers and teach them to work to limits of two or three thousandths of an inch or even finer. And it had to be done in a hurry. England needed the shells and Germany would not wait until we learned how to make them.

True, we had in Canada a large number of splendid mechanics who needed little or no training to enable them to handle this fine work. But a great many of them enlisted and many more went to England to work in the munition plants there. This left us sadly handicapped at a time when we were in dire need of the best mechanical skill obtainable.

That we did succeed is largely due to the untiring energies of the manufacturers and too much credit cannot be given them.

To-day we have many thousands of men and women successfully handling this very finest class of work. They learned under the stress of the moment and because it was absolutely necessary for them to learn, for their work at that time was indispensable to England.

And what they have learned they will not forget. After the war if they do go back to their old trades they will unconsciously do better, finer work. The need for this has been drilled into them for nearly four years. They will be better workmen and will command better wages.

But They Learned It

A typical case of this follows. Early in 1915 a company in a small town near Toronto obtained a contract for 4.5-inch brass nose sockets. Their regular line of work was on iron castings. They had a splendid organization and many loyal men. But when it came to getting down to fine work they failed badly. Government inspectors were sent to the plant with orders to give the management all the help possible in the manufacture of the sockets.

One of the inspectors in helping a man to set up a machine, made the suggestion that if a certain measurement on a roughing cut was made one-sixteenth of an inch smaller, it would make the succeeding operation easier and quicker.

The man opened his mouth in blank amazement and stared at the inspector. Then drawing a blacksmith's scale out of the leg pocket of his overalls he examined it carefully, glancing scornfully at the inspector from time to time. Finally he folded up the rule and put it away, saying, "Say, boss, when you start to talk about sixteenths of an inch around this shop you are in the wrong boat. If you talk of eighths I might be able to follow you. But nothing less than that goes around here."

A few days ago this same inspector met the workman —Jones, we'll call him—on the street. He didn't know Jones. Jones was neatly dressed and appeared prosperous, and in general looked more of a success than he did three years ago. Jones had to tell his name, for the inspector could not place him as the man who did not know what a sixteenth of an inch looked like.

It seems that Jones is now working in a factory making shell gauges. He has learned his lesson. He now not only knows what a sixteenth of an inch is, but is on familiar speaking terms with ten-thousandths of an inch, pitch diameters, root diameters, thread micrometers, vernier scales and all the terms and instruments used in fine mechanical work.

So "it's an ill wind that blows nobody good," and the above case is typical of thousands of others. In fact the education value of the munitions industry in Canada can never be indicated in dollars and cents. But the workmen and women who have learned will be better workmen and women and better citizens hereafter because they are more efficient. And in these days of manufacturing competition it is efficiency that counts.

But Times Change

I USED to think I'd like to have a job of bein' a king, or else an emperor or duke or some such hefty thing, to have a crown stuck on my dome and set upon a throne, and havin' fifty thousand folks a-dustin' round your home.

To say unto this man, get out, to that chap, come in, to see them hustle off the porch and 'op about like sin.

To always have a dollar bill to blow just when I please, and not to hear my creditors line up and snort and wheeze. To have ten pairs of boots to wear and sixteen suits of clothes, by heck, that gent would have no frets, no troubles and no woes.

But just the other day the folks what dwell about Berlin, they pulled a trick that worried me and got beneath my skin. They went unto the Kaiser's place, they pounded on the door, and walked with muddy, ob'-nailed boots upon his parlor floor, and took the crown from off his brow and gave it to some jay, who used to wear a homespun gown and dine on bread and hay.

And then they turned again to him what ruled the German land, and they had blood within their eye and muscle in their hand, and said: "Now, Bill, hoist out of this, and move your wife from here, for after this you'll drift and earn your wieners and your beer."

I'd rather have some lowly job, where I could show my worth, where I could take a pick and gouge some holes into the earth. Where I could hear the boss come 'round and say, "You are a bird, I'll make you boss some day, you jay, of all the bloomin' herd. You'll rise to be a dandy here, the banks will court you soon, I'll give unto you ten bucks more and holidays in June."

No, this here job of kingin' and emperorin' over folks, and tryin' to stand in sideways with all the warrin' blokes, it ain't just what it used to be, I'd rather be uncrowned, the way they're grabbin' things and tossin' them around. —ARK.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

MAKING A RECORDING STEAM CONSUMPTION METER

By T. H. FENNER, Associate Editor.

THE necessity often arises in plant and factory operation to determine the amount of steam consumed by a particular apparatus. This may be occasioned by the requirements of the cost accounting department, or by the desire to compare two different ways of operating the same unit, or the relative merits of two different appliances for the same purpose. For all these purposes, accuracy is the essence of the contract, while the question of obtaining accuracy with small expense is also important.

Methods of Measuring Water

If there are suitable tilting traps on the premises, to which a counter can be attached, registering the number of times the trap discharges in a certain time, then the volume of the trap being known fairly accurate results can be obtained. However, there is always room for inaccuracies to creep in, through leakage from glands, valves, etc. If all working parts are perfectly free to move, the trap will be sensitive, and open and shut promptly, while if the gland packings are at all hard, or unduly tight, the trap is slow to open and discharge and steam is blown through for a moment after the condensation has been removed. Errors like these are small in themselves, but multiplied by a large number of operations extending over days, they make a respectable total, and render valueless any test that does not take them into account. An ordinary water meter may be used, but these are by no means to be depended on. If a Venturi meter can be connected up to the return pipe, it is possibly the best means of securing the consumption, but a large number of plants do not possess these instruments, and where they are installed they are usually connected to the boiler feed, and are not easily moved.

Needed a Meter

The writer had occasion some time back to determine the steam consumption on a number of different kilns, used for baking Japan, varnish. etc., also lumber drying kilns. As the results were to establish the cost of production of various parts, accuracy was necessary, while at the same time it was not desired to go to much expense in securing the figures. Under these circumstances a search around the plant was made for suitable equipment. There were a variety of traps on the premises but none on which much dependence could be placed for a particular job of this kind, so they were eliminated from the list of possibilities. However, in looking around a store house of obsolete or unused machines, several steel tanks that had been used in the plating room, were discovered, and these suggested the idea of making our own measuring appliance, which was at once acted on, the result being a very serviceable instrument, at practically no cost.

HOME-MADE WATER METER

How It Was Made

The tank, as shown in the cut was mounted on skids, and kept about 18-inches off the floor. This was to give room for the discharge pipe to come below the bottom of the tank. The general arrangement can be followed easily by referring to the cut, and the action was as follows. The condensation was led into the tank from the kiln to be tested by a half-inch pipe. A 2-inch nipple with a long thread was screwed into the side of the tank near the top, and a union put on inside the tank, to connect the suction leg of the siphon pipe. The down leg of siphon was connected to nipple through the elbow outside the tank as shown ,and the pipe carried down low enough to give a good discharging head. On the end of the discharge pipe a clock valve was fastened by a hinge, and on the opposite side to the hinge a lug was carried out, to which was fastened a wire, the other end being fastened to a beam in the ceiling, and a light spring conneeted between.

This valve and spring were the key to the whole affair, and some considerable experimenting had to be made before the correct strength of spring was arrived at. This spring had to have just enough tension to balance the column of water in the siphon pipe, so that the instant the water rose above the top of the pipe, the valve would open. This would start the siphon, and the velocity of the escaping water held the valve open till the water was emptied down eo the level of the bottom of suction pipe. The spring would then close the valve, and the tank fill again. Here then, we had a definite quantity of water discharged, and all that was wanted was a means of recording the number of times the tank was filled and discharged in a definite period, and make one necessary correction. This correction was the quantity of water flowing into the tank from the return pipe while the siphon was discharging. This was merely a matter of placing a T on the return pipe, with a valve outside the tank. A pail was placed under this, and the tank watched carefully, and as soon as the siphon opened, the valve on the return pipe was opened and the water ran out into the pail instead of the tank. As soon as the tank was emptied, the valve was closed and the water in the pail weighed carefully. This weight had to be added to the weight of water discharging from the tank, to make it correct.

The Recording Chart

For recording the number of times discharged, a chart, registering automatically was required. This was secured by purchasing for 75 cents an ordinary domestic alarm clock. The fingers and dial were removed, and a tin dial soldered onto the spindle of the hour hand. Four small cleats were made on the new dial to hold a paper chart. A flat piece of wood, 1-inch thick by 6-inch. square formed a float into which was fastened a piece of ¼-inch round iron, which passed through a guide fixed on the flanged edge of the tank. A cross beam of wood was connected to the top end of this and this was supported on a fulcrum about two-thirds of its length away from the float rod. The other end carried a vertical rod, through which was passed the pencil. A stop was placed on the float rod, to hold the float up when the water dropped below a certain level. This level was adjusted to give just enough upward travel to the float when tank was filling, to make a mark of 1½-inch. long on the chart. The charts were placed on the dial at 7.00 a.m. and 7.00 p.m. and thus a continuous 12 hours record appeared on each chart The position of the clock is shown on drawing. In the actual layout the clock was enclosed in a wooden box, to protect it from steam, and dirt in the air. The valve on the bottom of siphon pipe was made of two pieces of galvanized iron No. 16 gauge, one soldered to the other. The top piece was of just sufficient diameter to enter the pipe neatly, while the bottom piece was made to the outside diameter of the pipe, and two lugs made on it, one for the hinge the other for the wire. A piece of good 1-16 wire wove insertion was made to fit the end of the pipe, to form a joint, and fastened onto the valve to begin with by shellac. Otherwise, the rush of the water would have washed it off. Later on this insertion joint was replaced by a ring of square rubber, ¼-inch wide by ⅛-inch thick. This was more satisfactory. Later on two more tanks and clocks were added, to enable three different tests to be made at once. This method resulted in accurate figures being furnished, and the only new material was the three clocks costing $2.25. The pipe and fittings were all on hand, and the labor amounted to probably another $2.

CUTTING LUBRICANTS THEORY AND PRACTICE

A MEMORANDUM on cutting lubricants and cooling liquids issued as Bulletin No. 2 by the Department of Scientific and Industrial Research, England was prepared in connection with a survey of the field for research or lubricants and lubrication. While the bulletin is not claimed to contain new knowledge, it is published in the belief that it furnishes a large amount of useful information which will be new to many users of cutting lubricants and likely to increase the efficiency of production in operations concerned with the cutting of metals.

The materials discussed in the first part of the memorandum, which is by Mr. T. C. Thomsen, are classified as soluble oils, which are oily liquids that form emulsions when mixed with water; soluble compounds or cutting compounds, which are greasy pastes that form emulsions when mixed with water; cutting emulsions, formed by mixing soluble oils or soluble compounds with water; and cutting oils, such as lard oil, rape oil, mineral oils, or mixtures of such oils, free from water and soap, which ordinarily do not form emulsions with water.

Characteristics and Preparation

The mineral oils best suited for use as cutting lubricants, either alone or mixed with animal or vegetable oil, are preferably of pale color and low viscosity, ranging from 100 to 200 seconds Redwood at 100° Fahr.. those of lower viscosity being used for high-speed conditions, and those of higher viscosity for slow speeds. Tinged lard oil, containing as much as 10 or 15 per cent. of free fatty acid, is the animal oil most frequently used either alone or in admixture; prime lard oil, which is almost free from acid, is more expensive, but is less inclined to gum under severe conditions of heavy cut and high speed. Wherever possible a mixture of lard oil and low cold test mineral oil is to be preferred on account of greater fluidity in the cold. Cottonseed oil oxidizes more readily than rape oil, and should not be used for cutting lubricants that are to be employed in a circulation system. Animal oils are not so easily oxidized in circulation systems as are vegetable oils, and lard oil produces deposits in such systems under severe operative conditions only when the percentage of free acid exceeds, say, 10 per cent. Cutting oils are nearly always used "straight," i.e., without admixture of oils; some of them containing at least 5 per cent. of free fatty acid and preferably over 20 per cent. of saponifiable (animal or vegetable) oil, may be used either straight or in the form of cutting emulsions. They will emulsify with water to which the requisite amount of alkali (soda ash, borax, etc.) has been added.

Soluble oils are prepared by dissolving a soap (usually less than 20 per cent.) in a mixture of mineral oil (usually less than 70 per cent.) and saponifiable oil (usually more than 15 per cent.). The oils used for making the soap are either animal or vegetable (lard oil or other olein from animal fat, whale oil, wool grease, castor oil, sulphonated castor oil, rape oil, cottonseed oil, resin, etc.), and are saponified with caustic soda or potash. In some cases a small percentage of alcohol or ammonia is employed to promote the formation of the emulsion. Soluble compounds are made on similar lines, except that they contain 10 to 50 per cent. of water and are in a semi-solid and semi-emulsified condition. They are not so easily mixed with water as soluble oils, which therefore are usually preferred.

Purposes of Use

Cutting lubricants and cooling liquids are used for the purposes of cooling, lubricating, producing smooth finish, washing away chips and protecting the finished product from rust or corrosion.

The importance of properly cooling the product, particularly under high-speed conditions and with materials such as aluminum which have a high coefficient of expansion, lies in the fact that the material is warmed by the heat developed during machining, and contracts on cooling, its dimensions then differing from the measurements taken during machining. Excessive heating of the tool causes the cutting edge to wear rapidly; in a tool of large section the heat is more rapidly conducted away than in one small section. Efficient cooling of the tool edge increases output; with high-speed steel the gain in cutting speed on steel and wrought iron is from 30 to 40 per cent., and on cast iron from 16 to 20 per cent. Efficient cooling of the shavings on the side not in contact with the tool is particularly important in tough material, helping to reduce the friction produced by the shavings rubbing against the nose of the tool. Lubrication is of little importance where the manufactured article is made of brittle material, but is very important where the metal is tough and is removed as spiral shavings which grind their way over the face of the tool. The heavier the cut the greater the necessity for lubricating the nose of the tool.

When the requirements of cooling and lubrication are satisfied the finish will be good. Cutting oils of great oiliness are required for a very smooth finish, and for this purpose some engineers find vegetable oils, such as rape or cotton seed, preferable to either mineral or animal oils. Dies, taps, reamers and form tools have a longer lift when used on tough steel if a cutting oil is employed in place of an emulsion prepared from a compound or soluble oil. For finish boring, rifling, etc., a mixture of 1 part of castor oil to 3 parts of mineral cleaning oil (gravity about 860-890) has been used with good results; the addition of an equal volume of turpentine substitute (white spirit) causes perfect solution to take place and is said to be advantageous for finish turning on guns and hard material.

The washing away of chips is often quite an important function of the cutting lubricant or cooling liquid, particularly in cases of deep drilling and in most milling operations. In boring deep holes, gun-tubes, etc., a solution of 50 lb. of sodium carbonate and 25 lb. of soft soap in 200 gallons of water has given very satisfactory results. If the cutting emulsion is too weak it will not carry away with it the minute particles of metal and scale, which may prove detrimental to the machine tool.

Good cutting oils used straight will not cause rusting, but those containing fixed (animal or vegetable) oils, such as lard oil with a large percentage of free fatty acid, will give rise to verdigris on brass. Vegetable oils such as rape, with a small percentage of free acid, do not produce verdigris unless they are rancid. Cutting emulsions made up from cutting compounds or soluble oils and water cause rusting if they are used too weak or if they contain acid. Water containing sodium chloride is most destructive to emulsions and must not be used, nor must hard water on account of the precipitate caused by the calcium and magnesium salts in it. Emulsions of oil and water are not stable in the presence of even minute quantities of acid; to a limited extent they can be reformed by neutralizing the acid with ammonia, but excess of alkali may facilitate corrosion.

Factors in Selection

Low speeds and shallow cuts require little cooling and lubrication. Low speeds and heavy cuts demand a lubricant of great oiliness, particularly if the material is tough. High speeds and shallow cuts demand a cutting medium with great cooling properties; hence emulsions are favored and should be used if the speeds are particularly high. Turpentine substitute is a satisfactory lubricant for aluminum, but being inflammable must be used with care. A mixture of paraffin oil and lard or other cutting oil for high speed work on aluminum is also dangerous, and has led to several fires. Cutting emulsions which possess the necessary cooling properties, and are not inflammable, are to be preferred.

Cutting emulsions are nearly always used for brittle material, and frequently for tough material if the speeds are high and the cuts light; when the material is tough and the cut heavy it is necessary to employ cutting lubricants used straight and containing 10 to 50 per cent. of animal or vegetable oils, or consisting entirely of such oils. Emulsions, in some cases, have been found to form a deposit on the working parts of automatic screw-cutting machines; this may be avoided by using straight oils, but emulsions should be adopted wherever possible, in view of the present scarcity of oil. The amount of soluble oil or soluble compound used in preparing the cutting emulsion varies from 2½ to 20 per cent.; the richer mixtures are used for severe conditions, and the weaker for light duty or for materials like brass and aluminum, where there is no danger of rusting.

The cutting lubricant may be applied by hand by a drop-feed system, or by some system employing gravity or pumping. In large machine shops the cutting oil is sometimes circulated in pipes throughout the works, returning through other pipes to a central tank; group systems with central tanks are excellent where one mixture is used for all the machines on the circuit. The return pipes should be large and arranged for easy access for cleaning; isolating valves should be employed to sectionalize the system when large; efficient strainers should be fitted on all return pipes and pump sections, and should be cleaned daily. Tanks, as a rule, should be cleaned out every four weeks, and return pipes every four months. Any scum formed should be skimmed off the tanks daily. It must be remembered that the oil or emulsion, in any system in which it is circulated over and over again, is exposed to the admixture of dust and dirt from the machine shop and to the oxidizing influence of air. The suction of any pumps that are employed should always be covered to prevent air from being drawn in, since aeration of the oil or emulsion has a strong oxidizing effect upon it.

Effects on Health

In the concluding part of the memorandum, Dr. J. C. Bridge deals with skin diseases produced by lubricants. He describes oil rashes as being, generally speaking, of two kinds—one due to the plugging of the small glands at the root of the hairs on the arms and legs of workers, and the other to mechanical injury to the skin produced by metallic particles suspended in the cutting lubricant. Primarily the first is purely mechanical. The plugging of the minute openings of the glands by the mixture of oil and dirt sets up inflammation round the hairs, and this may lead to suppuration or abscess formation. Injury from suspended particles occurs chiefly on the hands, where two surfaces are rubbed together, e.g., the skin between the fingers. Injury to the skin may also be produced by wiping the hands or arms with a cloth or rag when they are coated with a film in which metallic particles are suspended. Such injury permits the entry of germs and causes septic infection.

Methods of prevention include cleanness of the workers of the lubricant and of the machines. Washing accommodation must be on a liberal scale, and hot water, soap, and scrubbing brushes are essential. Workers should be instructed not to wipe their hands on rags before washing and to avoid washing their hands in the cutting compounds. Either soap, which dissolves oil, has been found useful in preventing inflammation of the hair follicles, and dusting the arms with a powder containing equal parts of starch and zinc oxide before starting work prevents the action of the oil on the skin.

In handling of the constituents of the lubricant before blending care must be taken that they have not undergone changes such as the formation of free fatty acid. Constant removal of metal particles is necessary; filtration, such as is provided on the machines, and centrifugal action are insufficient. When straight oils are used their viscosity can be diminished by heat sufficiently to allow the particles to sink without affecting the lubricating value, and this operation completely removes the particles. Where this procedure is impossible constant change and renewal of the lubricants are necessary. Frequent cleaning of the machines, with removal of all old lubricant from their parts, is essential.

Various antiseptics, carbolic acid (1 to 2 per cent.) being the most common, have been added to the lubricant to prevent rashes, and in the case of cutting emulsions disinfectants soluble in water have been used to the extent of 0.5 per cent. for the same purpose. The results, however, have not been altogether satisfactory, and the method cannot be relied on to prevent skin rashes. Heating the cutting oil to 300 ° Fahr. for a short period, with the object both of sterilizing it and of increasing its antiseptic or germicidal action, has been suggested, laboratory experiments in America having shown that oil which has been heated by use possesses rather marked germicidal effects. Apparently heating new oil does bestow germicidal powers on it; the actual temperature required has not been determined but is above 125° C.

Workers whose hands have become the seat of septic infection should not be allowed to work on machines as they are liable to infect the oil with germs and so infect others. As a general rule frequent washing with soap and hot water is sufficient to bring about rapid cure of folliculitis produced by plugging of the glands. Subsequently the skin may be dusted with zinc oxide and starch powder, and where this has been insufficient a mild antiseptic applied on lint has relieved the irritation and given good results. Septic infection of the skin due to cuts should be treated on general principles with suitable antiseptic dressings.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

NEW FULFLO PUMP

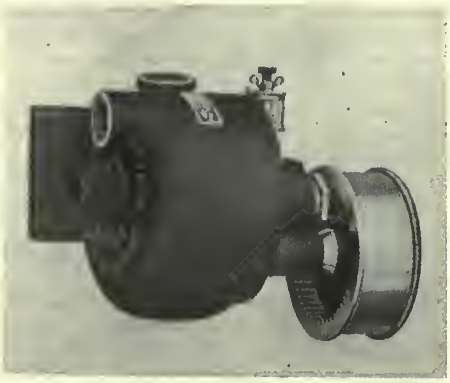
OWING to a demand from manufacturers of small grinders, drill presses, milling machines, hack saws, etc., for a smaller size "Fulflo" pump, the Fulflo Pump Co., Blanchester, O., have developed the small direct driven pump illustrated herewith. This pump is provided with a ⅜-inch intake and outlet, and has a capacity for pumping up to 5 gallons per minute when compound or water solutions are used, and 3 gallons per minute when mineral lard or oils of like viscosity are handled. Like all of the "Fulflo" pump designs, this type is centrifugal in action, and it may be placed above the level of the liquid, and absolutely retain its prime under all conditions without the aid of valves or other mechanical means. There is but one internal working part—the impellor—that does not depend upon any contact fits for pumping efficiency; consequently it is not affected by grit, chips or other abrasive matter that is always present in the liquid being pumped. The pressure is not cumulative and therefore no relief valve or overflow piping is required, since the flow is entirely controlled by a stop cock at the outlet of the piping, which may be opened or closed at will. The pump may be permitted to run indefinitely with the stop cock closed without damaging either pump or piping.

There being no passages in the pump interior smaller than the intake and outlet obviates all possibility of clogging, and anything that can be sucked in will pass through without damage. Bearings do not come in contact with the liquid pumped, and are oiled through lubricators that are supplied with pump. The shaft of the pump is hardened and ground, made of cold rolled steel, all other parts except bearings which are bronze, are of cast iron. Pumps can be furnished of brass or bronze. The packing is of flexible metallic type, not affected by any liquid either hot or cold.

The pad for mounting is located at the bottom of the pump, but when it is desirable, an angle bracket is furnished on which the pad can be bolted; this allows the mounting to be made at either the back or the front of the pump as may be desired.

The over all dimensions are 7⅞ in. x 5 in. The pump has a greater capacity by 50 per cent. than any other type of pump manufactured for machine tool use of equal size. The driving pulley is 1½ in. in diameter; 1 in. or 1¼ in. single belt is used. The pump is built to stand speeds up to 3,500 r.p.m. Weight, complete, about 9½ lbs.

To give an idea of the capacity and flexibility of this little pump, at 2,100 r.p.m. with a 12 in. suction and a 4 ft. head lift the flow will be 3½ gallons per minute. With the same suction and the same head lift at 2,600 r.p.m. the flow will be 5 gallons per minute. With a 30 inch suction and a 10 ft. head lift, at speed of 3,000 r.p.m., the flow will be 5 gallons per minute. With a 30 inch suction and an 18 ft. head lift, at speed of 3,500 r.p.m., the flow will be 3½ gallons per minute. It will thus be seen that this pump is capable of supplying any machine tool that does not require more than 5 gallons per minute of liquid and will meet any possible condition that may be demanded at any machine shop.



NEW FULFLO PUMP

SHELL LATHES

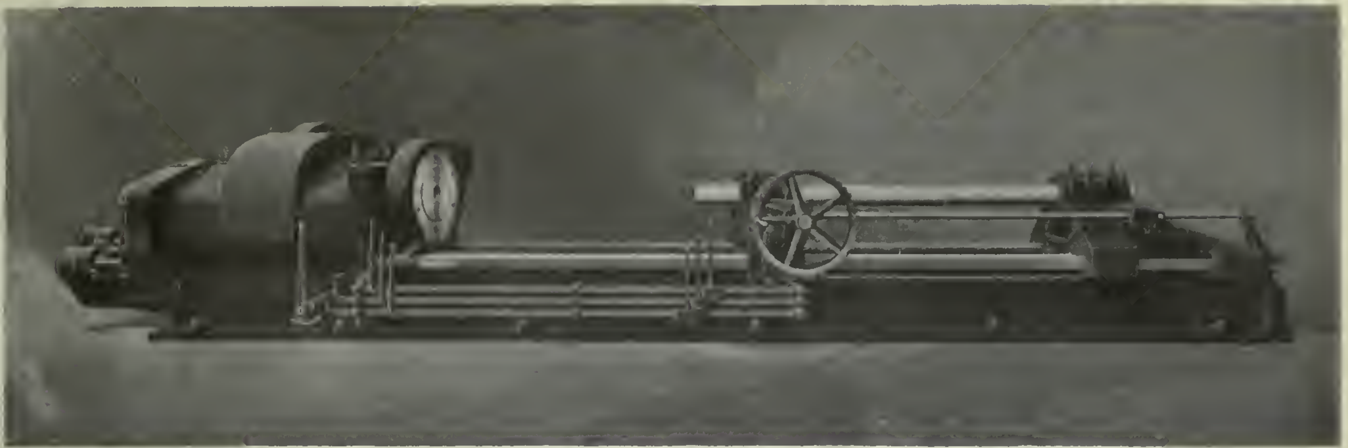
The Amalgamated Machinery Corporation, Chicago, now has nearing completion the first of 168 large lathes for turning and boring shells in the Neville Island, Pittsburgh, ordnance plant which the United States Steel Corporation is building for the Government.

The turning lathe is 29 ft. 9 in. in length over all; 5 ft., 3 in. in width, has a swing of 39 in., and at the headstock end is 6 ft., 8 in. in height. The total weight is approximately 65,000 lb. The new machines embrace several novel features apart from their massiveness. The spindle has a double drive; there are unusual and convenient means of control; the feed screw is placed in the center of the bed, instead of outside and through the apron of a carriage; there is a specially-designed method of turning the curved portion of the shell, besides other features, as will be described.

The bed and headstock are cast in one piece. The machine is belt-driven by a 12 x 16-in. pulley on the first driving shaft, the pulley being equipped with a friction clutch, thus obviating any overhead countershaft with tight and loose pulleys, or other overhead contrivances for starting and stopping the machine. The speed reduction gears are contained in the headstock, four gear shifts giving four spindle speeds with a constant speed of the first driving shaft. The gear ratios are 27.3, 31.3, 36.1 and 42 to 1.

The driving gear changes have been so proportioned that when the work is changed from shells of one size to another the cutting speed may remain unchanged. The feed change gears are easily accessible through a door at the end of the headstock. The faceplate itself is a gear, while also on the spindle, back of the front bearing, is another gear, the teeth of the two being staggered, thus distributing the application of power and averting a tendency in the spindle main bearing to wear bell-mouthed.

Because of the contour which must be given the shell, both cross slides are fitted with forming attachments that are fastened to the carriage at the back. The one which enables one tool to form the flare is a simple arm connected with a block which slides in a slot that inclines toward the axis of the shell and in the direction of the live center. More complicated, though still simple, is the arrangement for compelling the other tool to follow the proper curve to be imparted to the nose of the shell, this end being toward the dead center of the lathe. In this case, two arms radiate from a point on the slide to which they are firmly attached, forming a triangle, the two back corners of which



SHELL BORING LATHE

are attached to blocks that slide in a cam slot having its outline curved to correspond with the curve of the shell. The result is that the tool moves with a motion similar to that which it would take if it were pivoted on an arm several feet long, the tool and holder being at all times at right angles to the work, a phase of the arrangement which is considered most important as it obviates any tendency of the tool to mount the curve in steps and causes the proper cutting edge to be presented to the work at all times. The cutting edge does not change as it would if the tool were at right angles to the axis of the shell.

The carriage consists in part of what is termed a master carriage, this being in reality the base and the part that rests on the ways and that carries the nut through, which motion is imparted by the feed screw. The upper part of the carriage, including the cross slides and the apparatus for giving the proper contour to the shells, is easily changed for each size of shells.

The tailstock is of heavy design corresponding to the other parts of the lathe, and is held secure to the bed by eight 1½-in. bolts. The spindles, both live and dead, are 7 15-16 in. in diameter.

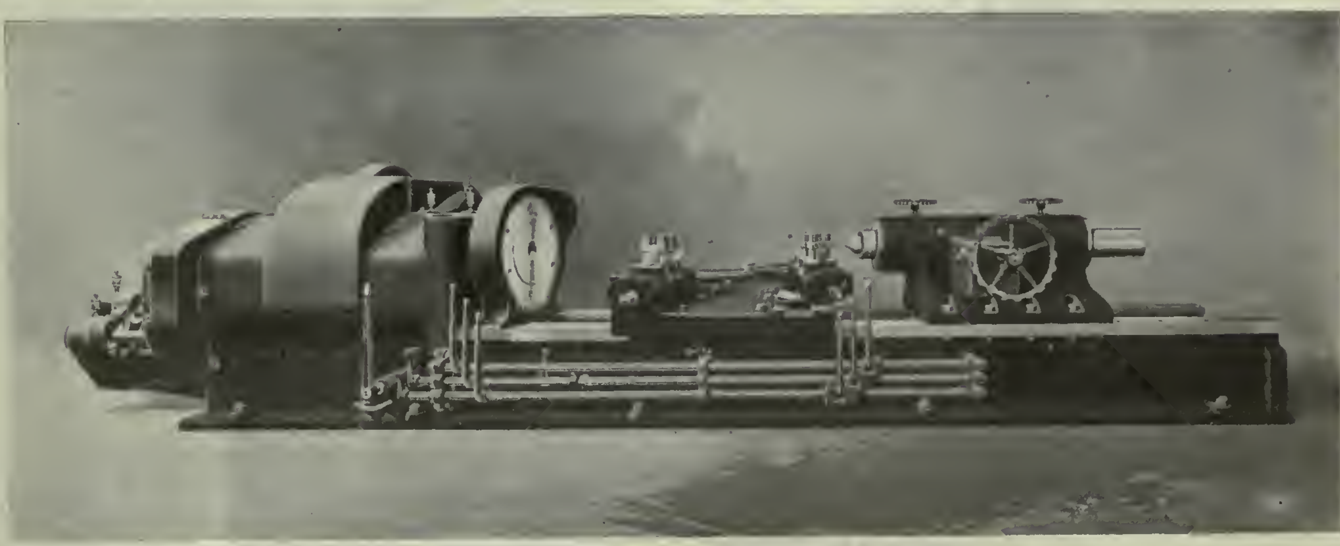
The boring lathe differs from the turning machine in that the carriage and tailstock are eliminated and replaced with the necessary equipment for holding and operating a boring bar, the end of which is bored to take a taper shank attached to a boring head carrying the cutters. The boring bar is 7 15-16 in. in diameter, and 11 ft., 6 in. long. It is supported by a rest in which it slides, and by a carriage in which it is clamped and keyed. The rest is fitted with a bushing and is moved by power, having a half nut which meshes with the feed screw beneath, and is made to move by lifting a lever.

An important feature of the boring-bar carriage is an arrangement whereby the movement of the carriage and consequently the feed of the bar can be retarded or accelerated by turning a hand-wheel on the rest, thus virtually giving the bar the advantage of hand feed when it is desired. The handwheel being on the rest makes it conveniently located, along with the other controls, for the operator. The main points of design which enable the boring bar to be controlled by hand, are as follows:

The carriage is driven by a nut on the feed screw, the nut being supported in a bearing in which it can revolve. At one end of the nut is a worm gear meshing with a worm, the latter being turned one way or the other at will by the operator manipulating the handwheel. He can thus nullify the movement of the feed screw, reduce the movement imparted by the screw or make the carriage move faster. Left alone, the nut and carriage move at the uniform speed imparted by the feed screw.

Another feature of the carriage is the manner in which its tendency to tilt upward in front from the pressure of the boring bar is overcome. Ordinary procedure would be to gib the base of the carriage under the ways, in which case the strain would be on the bolts holding the gibs to the carriage castin·· avoid this, the carriage is cast with a hook-like bearing surface on the under side of the ways, and the gibs proper are placed on the top of the ways with suitable screws for adjustment. At the rear end of the carriage, gibs are used in the customary manner.

Shelburne, N.S.—The schooner, "Jean MacKay" was successfully launched last week. She is owned by Patten and Forsey, Newfoundland. Rigging is proceeding.



SHELL TURNING LATHE

The Courage of the Rail Splitter Needed Now

Canada's Industrial Future Now in the Melting Pot—A Better Labor Market Than Before the War Industries Came—What the Manufacturers Expect of the Government in Way of Co-operation

THE coming of peace was not a surprise to Canadian manufacturers. They had known for a long time that it was on the way. They had figured out in a good many cases what they would do when the glorious day of peace did arrive. But its coming has caused a little jerk just the same.

Right now is the time for the Canadian manufacturer to show his common sense. If he has been in war work he has been able to run his plant on munitions contracts while others went to the front and took their lives in their hands.

His business has not been confiscated. His home has not been invaded nor have the members of his family been maltreated by invaders. He has not gone hungry, nor has he stood day after day in the stench and stink of a trench. The chances are that his plant is in better condition than it was before the war contracts came. The making of shells was simply a temporary piece of business, and he knew it before he ever went into it.

Apart from all that, there is the fact that the future must be faced right away, and it must be faced fearlessly and cheerfully. The present is no time for blue-ruin blatherskites to be turned loose in the land. It is above all else a time for quiet and serious consideration, for real assistance on the part of the government, and for courage and confidence on the part of the manufacturers themselves.

Has Opened Canada's Eyes

Canada has had a good chance to get her eyes open during the period of munitions making. This country has found out that it can compete with the world. It has made shells and fuses, its mechanics have worked to finer dimensions than they ever thought possible, and unskilled men are able to value the thousandth part of an inch.

Canada has developed her industrial nerve to a greater extent than ever before. There is no reason why, having learned quickly the making of shells and their parts, she cannot turn to lines that were never known to mechanics here, and which, in years gone by, we have simply passed along to other countries because we have taken it for granted that their enormous equipment and their outstanding industrial prestige have entitled them to the trade without a struggle on our part.

The Spirit of Lincoln

Right now we need the spirit of Lincoln when it came to dealing with the steel monitor.

Early in the war of the secession, Ericsson, a Swede in New York, invented a monitor and needed a government appropriation to build it. G. B. Fox, Assistant Secretary of the Navy, said the heavy armor would sink such vessels. "But," answered President Lincoln, "is not that a sum in arithmetic? On our Western rivers we figure just how many tons will sink a flat-boat. Can't your clerks do the same for an armored vessel?"

But that was too absurd. Why was it necessary when all rule-of-thumb experience was against such an idea—for there are rule-of-thumb scientists as well as business men?

Congress passed a special appropriation for the purpose, but the naval board, consisting of a commodore and an admiral, condemned the monitor. Ericsson went to Washington and argued the question in the President's presence with this board of naval officers. Again the board ruled adversely. Lincoln overruled the board and told Ericsson to go ahead. The result was the "Monitor," and the subsequent triumph over the "Merrimac." The principle of the armored vessel was practically established. That was an instance in which the common sense of the rail-splitter, with the memory of his work on a Western river, overruled the rule-of-thumb "experts," who obeyed only the law of precedent, but had neither common sense nor open-mindedness towards innovation, as a part of their science. Lincoln's common sense could see no essential difference between the boats on the sea and the boats on the river.

Canada needs to develop a splendid disregard for the shiver that says, "Can't do it." It can be done. It doesn't make any difference whether it's been made here before or not. Neither shells nor fuses were made here before, and the operations on each are of very close dimensions. Canadian manufacturers doubted their own ability and the ability of their mechanics to make shells and fuses. Canadian manufacturers and Canadian mechanics have demonstrated beyond a doubt that they can make shells and fuses.

What Manufacturers Want

A deputation of Canadian manufacturers went to Ottawa recently and submitted the following outline on "reconstruction":

"The most pressing problem at the close of the war will be to find employment for all available labor.

"The manufacturing industry will be more seriously affected than any other, and it is certain that unless the government takes immediate steps to assist the manufacturers to increase the demands for their products they cannot cope with the situation.

"Therefore, we would ask the government to seriously consider the following suggestions:—

"1. That the plan for building up an export trade to be submitted to the Reconstruction and Development Committee of the Cabinet by the export committee of the C.M.A. be adopted.

"2. That a commission be appointed to take a survey of imports with a view to ascertaining what part of such imports could be made to better advantage in Canada.

"3. The government publicity department should be instructed to start immediately a nation-wide campaign to educate the people on the importance of buying Canadian products, and we respectfully suggest that the policy herein advocated be adopted by the government as a fixed and permanent practice for the conduct of government departments.

"4. That the Dominion Government, the Provincial Governments and municipalities be prepared to start immediately after the close of the war, all necessary construction work.

"5. That immediate steps be taken to ascertain what use can be made, after the war, of plants employed during the war for the production of munitions and war supplies.

"6. That it would be in the national interests if, as far as practicable, our soldiers were returned to the provinces from which they came and that in determining the order in which soldiers will be returned the military authorities be requested to govern themselves in conformity with information to be periodically supplied them by the government employment bureaus as is hereinafter described.

"7. That government employment bureaus be started immediately and that one of the principal duties to be assigned them be that of surveying the labor market with a view to furnishing the military authorities with monthly reports showing both by location and occupations the number of men for whom immediate employment can be found.

"8. That a practical land settlement plan be worked out at once and in connection with same the publicity department should start a campaign to educate our soldiers in the advantages of farming.

"An interesting series of booklets should be supplied to our soldiers while they are still at war particularly designed to show that community farm life can be made not only profitable but socially attractive in the older as well as in the new provinces.

"9. The publicity department of the government should start at once an 'optimism after the war' campaign, and in this they should ask the press of the country to co-operate.

"The country is drifting into a pessimistic frame of mind as regards 'after the war' conditions; this might easily bring about far-reaching depression unless it is quickly checked.

"10. When the time comes for demobilization the Militia Department and the government employment bureaus should co-operate in order that the lapse of time between discharge and employment be as short as possible. Congenial work is not only an antidote for discontent but it will be a pleasant relief for the soldiers after the ordeals of war.

"11. Having regard to the important part which research must necessarily play in Canada's industrial reconstruction the appropriation for that purpose should be increased to not less than one million dollars annually, and that the administration should be entrusted to a board of business men.

"12. That the government in shaping its policy with regard to the problems of standardization and the cost of living should follow the practice that has grown up at Washington of calling the manufacturers and the representatives of their employees into consultation; that price arrangements rather than governmental fixed prices be made the governing principle so long as such agreements can be arrived at that will accord with the government's own sense of what is right and fair.

"13. The Dominion Government should contribute to the Provincial Governments for the development of vocational training.

"14. The Dominion Government should take some action towards developing water powers now going to waste.

"The government may rely upon the manufacturers collectively and individually to do their utmost to provide employment and to show proper consideration for all those who may be handicapped by participation in the war, but if the government will co-operate along the lines suggested above the manufacturers will be in a position to render much greater service than would be possible under ordinary conditions."

Expect Trade To Develop

The agricultural implement trade should be in for a period of expansion and development. That seems to be the consensus of men close to the trade with whom CANADIAN MACHINERY has discussed the matter. But they also point out that much depends on the encouragement and assistance they receive from the government. The government can play the game of business or it can play the game of politics. The breach between Western Canada's agriculturists and the manufacturing interests of the Dominion has not been bridged, and it is just possible that, unless wise counsels prevail, scheming politicians may see the advantage to further selfish political interests by driving this wedge deeper and pitting the Westerner against the manufacturer.

There should be a better labor market than ever. Mechanics will not agree that experience on a one-operation machine makes a mechanic out of a laborer. It's not worth while to argue the point, because the mechanic's contention is right. At the same time there are thousands of men, and women too, who have had several years' hard experience at doing things exactly right in the production of shells. This experience will be of unusual help when they come to work at peacetime lines.

Canada's position is strong. She has a host of people holding her bonds. Interest charges, large though they may be, will be paid largely in such a way that the money will remain in the country. She has resources capable of enormous development, and she has a place in the eyes and heart of the world that will stand behind every move she may make in industrial development.

For the present the big task is to be brave, hopeful, and big enough to meet the new situations that will arise in the very near future. These problems can be turned into stepping-stones to bigger and greater things, or they can turn themselves, through pessimism and indifference, into millstones that will put industrial Canada in a position of near bankruptcy and misery.

It's up to you. See to it, no matter what your calling or capacity may be, that you meet every situation with a firm resolve to conquer it, and that you regard every occasion as a great opportunity. Do this and the future has a wonderful development in store for us.

THE VISION OF AN OLD HAT

(Copy from New York Times)

Ninety-seven million rosy and comfortable people in this country pick out three million men and say to the three million men they have picked out: "You go into the jaws of death for us!"

Then what do the ninety-seven millions do?

God help us if there is a man or woman left before this week is over who is not acting or trying to act as if he or she were the whole ninety-seven million!

When a man cries out to me three thousand miles away: "Oh brother, won't you lend me fifty dollars to die for you with! "What can I do?"

I know one thing.

I am not going to be caught by my God higgling on the edge of his grave with him—with the man who is dying for me—as to whether I will have to run a little risk or not, or go without a servant or not, or wear my old hat!

What has risk to do with it?

The more risk goes with a bond the more decent a bond feels! My brother says to me: "I give my life for you!" I say to him: "Here is another inch I smoke on my cigars for you!"

Every man speaks for himself, but as for me—when I think of him—of the man who, without knowing it's a cross, has died for me—when I think of Him I wear my old hat through crowds while the tears roll down my cheeks.

How strangely the world is lighted up as I see the soldiers troop down the streets.

I think of nine hundred thousand dead English boys.

I think as our boys' faces pass of the nine hundred thousand dead English boys.

How the nine hundred thousand dead English boys light our boys' faces up!

I stand on the curbstone and watch our boys.

Down the street their faces go, and out to sea, silent, unmentioned, unknown, while the bands play —each with his shadowy cross on his shoulder!

Hundreds of thousands. Then more hundreds of thousands!

Hundreds of thousands of soldier boys bring back to me my God!

The Cross is no longer crowded off on to a lonely hill in Galilee two thousand years away.

I walk as in a dream past hundreds of thousands of crosses down the street!

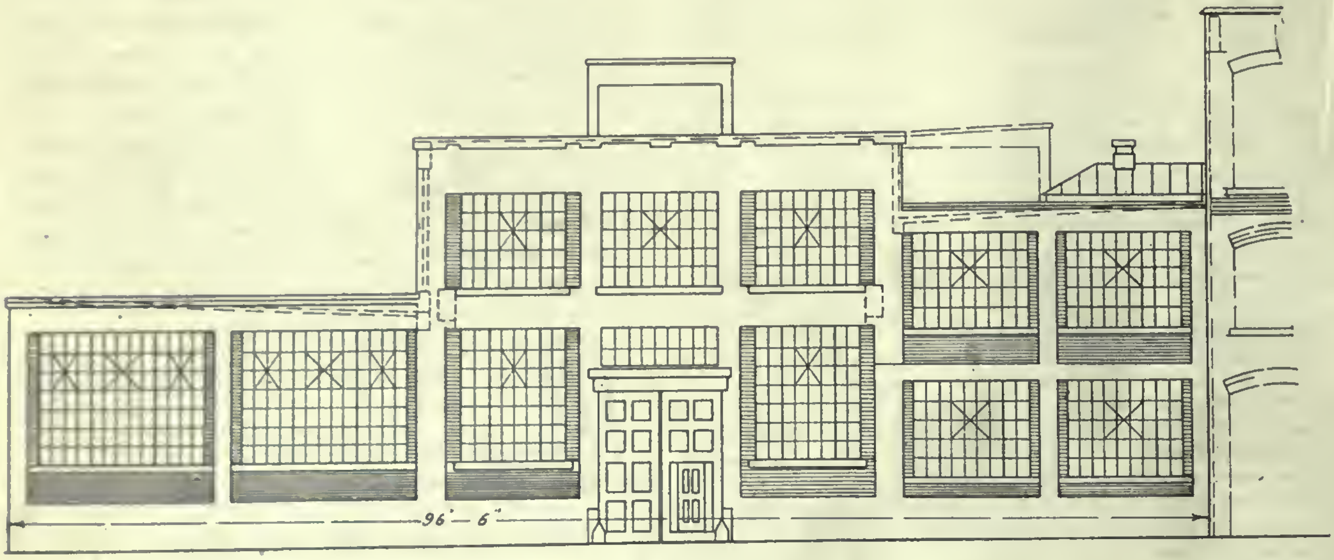
I have seen two thousand boys with crosses follow Christ up Calvary

That we may have a world children can say their prayers in!

AN OLD HAT SEEMS LITTLE ENOUGH

"GO! GO! NO LEFT TURNING"

New Grey Iron Foundry of Darling Bros.



THE steady increase in the business of Darling Bros., of Montreal, has required considerably more factory space during the past few years. While much of this has been the result of munition work the greater portion of the increased activity has resulted from the enlarged volume of orders for general contract work. The most recent expansion is in the foundry business, this development being virtually forced upon them by the existing situation created by the contingent difficulties in obtaining the necessary castings for the manufacture of their product. The inability of many foundries throughout the country to secure sufficient raw materials for their usual operations, created a situation where many essential industries—dependent upon outside sources for fundamental material—were brought to the point of establishing for themselves a source of supply upon which they could rely.

The new foundry of Darling Bros. had been under consideration for some time but was necessarily hastened by abnormal conditions arising out of the war. To meet the pressing demands for greater output the decision to construct the foundry was shortly followed by active operations, and work on the foundations was started early in the spring, and early in October the first cast was successfully made. The foundry building, which consists of the new addition and a small portion of the old structure which houses some of the auxiliary equipment, covers an approximate area of 18,000 square feet. The main portion is of the lantern type which provides abundant lighting to all sections of the floor and gallery, where the charging floor is located. The cupola now installed is of the 10-ton continuous type, and provision has been made for an additional unit of similar capacity. The blast for the cupola is supplied by a No. 4 Roots blower, with a capacity of 4,000 cubic feet of air per minute; this unit is operated from the line shaft.

Two ladles, one of 2 ton and one of 1 ton capacity, made by the Whiting Equipment Co. are provided, each of these being fitted with improved pin spur gear opening arrangement. The core ovens are built of brick and are equipped with the necessary shelves in addition to the portable car. Balanced lifting doors are also provided. The smaller oven was installed by C. J. Woodison Co. of Detroit, and is of the stationary type, set in brick. The cores are placed on swinging shelves, which operate independently of each other, allowing of the removal of the cores without hindering the baking process of the other shelves.

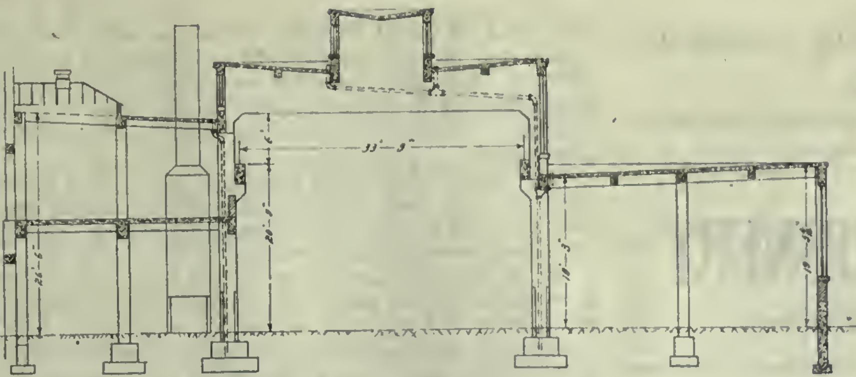
The central portion of the floor, where the heavy work will be done, is provided with a 4-ton electric traveling crane, operated and controlled from the floor level.

The fettling shop is amply provided for the cleaning and dressing of the castings before the same are transferred to the machine shop. The large Whiting tumbler is of the steel plate barrel variety driven off the line shaft. Emery wheel and air hammers are also provided. A power-driven elevator with a platform 5 ft. 6 in. by 8 ft., and with a capacity of 3,000 pounds, has been installed for supplying the charging floor.

The building is heated by the Webster vacuum system of steam heating, steam being delivered through a reducing valve from a 40 horse power return tubular boiler. The condensation is returned by means of a 5 x 6 x 10 vacuum pump, discharging to a receiver, from when it is returned to the boiler by a 5 x 3 x 6 boiler feed pump in the usual way. There is installed 2,000 square feet of direct radiation divided into 14 units capable of maintaining a temperature of 60° during the most severe weather.

Adjoining the foundry and in a section of the old structure is the pattern making department. This space has been enlarged and equipped with the latest type of modern wood-working machinery. This department which was formerly located in the main building across the street, is in charge of a competent super-

POURING: DARLING BROS.' FOUNDRY



CROSS SECTION THROUGH FOUNDRY

visor of long experience and a staff of efficient pattern makers.

The primary object of the recent development was for the purpose of supplying the need of their own business, but it is expected that general contract work will also be a feature of this new activity.

T. Pringle and Son, architects and engineers, were the designers and erectors of the building and the finished structure exemplifies the latest and most efficient practice in foundry installation and operation.

It is stated that during a recent French offensive the consumption of petrol for the army and air service was at the rate of 1,800 tons per day, which represents a daily consumption of approximately 500,000 gallons of petrol.

SUCCESSFUL WITH A "VOLUNTEER PLAN" AT THE BOWSER TANK AND PUMP WORKS FORT WAYNE, INDIANA

THE Fourth Liberty Loan Campaign at the Bowser plant was conducted strictly according to a "Volunteer Plan." The Allen County, Indiana, organization put on a "voluntary campaign" and the factories were asked to join in the spirit of the undertaking.

In previous campaigns a soliciting squad was organized which enlisted the services of practically 175 workers. The head of each department was designated as captain, and he would appoint as many lieutenants as necessary to get the subscriptions in his department.

This "Volunteer" campaign made it unnecessary for all of these workers to solicit the subscriptions. Everyone was urged to buy as many bonds as they could possibly afford, without being personally called upon to do so.

In consequence of the request, the old Bowser team organization which have operated in the past were not in existence. Three booths were set up in the plant where subscriptions were received. There was no soliciting—there was no urging—but every man and woman was permitted to work out the problem with his or her own conscience, and be the sole judge.

When the voluntary campaign closed Tuesday night, October first, the results were counted up and it was found that the conscience of the Bowser employees had been seriously at work without a single prompting from the old-time team organization. The employees had subscribed of their own free-will a larger amount, number of people considered, than was subscribed in the Third Liberty Loan campaign. The fact attests to the soundness of the voluntary subscription plan of a conscience campaign and at the same time speaks well for the state of health of the Bowser Conscience.

Fourteen hundred and ninety-five subscriptions were contributed to the Fourth Liberty Loan. No branch office nor salesmen's subscriptions were included in this. The firm deemed it advisable for branch office employees and salesmen to subscribe locally. The contributions were therefore solely from the home office and factory forces.

GENERAL VIEW OF DARLING BROS.' FOUNDRY, MONTREAL.

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After War Orders—What?

A PERUSAL of the armistice terms imposed on Germany make it quite certain that the German war machine has been smashed and crushed for keeps. The Allied nations, having been driven to war, resolved that they would make an end to it, and they have.

It almost looks like taking away a man's clothes and not extending the courtesy of a barrel in which to sneak home.

As a matter of fact, the German emperor doesn't appear to have a back alley left open to him.

Canada faces a new world. For all purposes, consider war contracts as finished.

Get the words of Prime Minister Hughes of Australia, who said:—

> "The war has destroyed all the landmarks of the world in which we used to live. Every day we confront a situation without precedent, and ancient traditions are buried beneath the burning lava of war. Nothing matters but that we should learn by experience to no longer waste our time in profitless doctrinaire discussions or drift with the backwaters of inaction."

That practically amounts to the statement that out of the cauldron of war has come a time for the Canadian people to develop to the full the initiative with which they are endowed; to forget past precedents that have held them in check, and to press on until they occupy the place in the world for which they have been so wondrously endowed by raw materials, boundless resources and a race of splendid men.

A Celebration With No Booze

A NUMBER of cities in the Dominion had a scare celebration on Thursday on the strength of the report that an armistice had been signed and fighting had ceased. In Toronto, during the affair, the suggestion was made in several sources that the ban on liquor should be lifted for 24 hours, in order that the celebration should be a mad one and a merry one.

Fortunately the suggestion never got to the stage where it had a good chance to sprout.

There is a feeling that liquor should have been freely spilled during the influenza epidemic. Booze has a string of victims to its credit that would make the death list from influenza look simply like an index to the chapters that follow.

A man who cannot celebrate the coming of peace and remain in his sober mind and in possession of all his senses had better not celebrate at all. It must be remembered that booze was shut out of this country in order that we might be more efficient to wage war. This young land gave a practical demonstration of her moral strength that England could not give. The Old Land was weakened by booze, and yet in the face of national disaster it could not rise in its might and strangle the slimy thing.

The industrial world in Canada is better by a thousand per cent. with John Barleycorn dead and buried than it ever was with him trotting around and making damn fools out of otherwise sensible men.

Be mighty careful when you take a hand in the business of rolling away the stone that is holding his carcass under the ground for the time being.

Booze is not dead yet, but the people who were soused in it before have had a chance to pull themselves together and appreciate the sensation of being sober and decent and 100 per cent. efficient.

Canada's a Great Place

CERTAIN factions of the Canadian press are given at times to discussing the degree of imperialism to which they are addicted. Apparently there are lukewarm imperialists to whom Canada is, and always will be, a colony and nothing else.

With all due regard to the policy of some of these papers, there is a great big work that remains for the Canadian papers to do, and that is to speak and think in terms Canadian.

This country is a great proposition. There is none better. The children in the schools should be taught that it is the greatest place under the sun. They should be etrly given the idea that Canada is a nation, not an offshoot.

Canada has been giving a demonstration in the last few years that should serve to let a little daylight into the skulls of some of the colonial-saturated folk.

This country has made a record on the field of battle that has not been surpassed by all the military traditions in the world. The Dominion has shown that the mechanics of this country are capable of making the Canadian shell shops the finest in the world, and shell and fuse making were new things to the Dominion. The very fact that the Dominion was able to maintain her leadership in this business shows that, with equal opportunity she could do the same in any other line that her pepople had the opportunity of tackling. Canada has developed her industrial nerve to quite a degree, and she is not minded to let it grow weak after the making of shells has ceased.

All this is well, but there are happenings at Ottawa that the Canadian press would do well to watch and watch carefully. This country is being too much governed by orders-in-council and the rule of censorship. The censorship of the Canadian press was never justified, and the serious-minded people resent it. It was a slam at the whole decent press because certain authorities had not the courage to handle a few renegade papers that council is dangerous; it is not a good thing for the government itself that has to abide by the decisions of the few of its members who put these things across; it is not good for the people of the country at learge who have to live under the half-baked legislation that is galloped through. The press of the Dominion can right now perform a real service by calling, irrespective of politics, for a cessation of the ruling of Canada by orders-in-council.

THERE'S three things you can't beat, the race horses, the stock market and the booze.

* * *

DON'T imagine you're a great patriot because you buy a war bond. It's a gilt edge security, and non-taxable. In fact it's the best investment in sight, and buying them isn't nearly so risky as fighting at $1.10 per day.

HAD TO START ALL OVER—BUT HE DID IT

Frank W. Barron Recollects His Apprenticeship at Time the Roller Boat Was Being Built

THE temperance wave swept many hotelmen off their feet. One of them was Frank W. Barron—for three years proprietor of the Oshawa Hotel at Oshawa, Ontario, and now, little more than two years later, mechanical superintendent of British Acetones, Toronto, Limited. This is the story of how he came back.

"Remember the Knapp roller boat?" he asked. "About the time I finished my apprenticeship with the Polson Iron Works she was ready to ride the Bay. I had helped to build her.

"Knapp was a clever fellow and he had several intelligent and moneyed backers. But a number of the workers had misgivings. One of them swore she would fail. To him—a little Irish sailor from the Upper Lakes—she was a monstrosity, a fool thing designed to outlaw the sanctity of water."

Five years in the Polson Works was time well spent to Frank Barron, ambitious to become a mechanical engineer. Not more than eleven or twelve years old when he started at Polson's, he was still a lad when he left to work in Eaton's power plant under E. J. Phillip, who is now with the Belleville Locomotive Works.

It was while with Phillip that young Barron formed the study habit. In fact, he was probably one of the first Canadians to mix advanced theory with practice by enrolling for a correspondence course in mechanical engineering. But toward the end of five years, hard study on the top of hard work—and it was work underground in the Eaton plant—started inroads on his health.

He left Eaton's and went as erecting engineer with the Wrought Iron Range Company, of St. Louis. And with the change his health improved — likewise his finances.

But when all's said, there's always room for another snug nest among Canada's maples, and Frank Barron, acutely aware of this after five years away, demonstrated that no inducement in even "show me" Missouri could hold a homing bird.

The Copland Brewing Company started him as chief engineer; promoted him to plant superintendent; later to superintendent of construction. And when he signified a desire to go into the hotel business, it was this company's capital plus his own considerable savings that gave him proprietorship of the Oshawa Hotel.

"Out of the wreck," he said, speaking of the prohibition enactment, "I saved nothing but the farm that had provisioned the hotel table. I'd have gone on it at once had I known farming, for there were my wife and three boys to provide for.

"One day I heard that the Whitby Asylum needed a night engineer. I applied for the job and got it. And I managed all right, for I had plenty of time to think before I had to act. But had I first of all attempted the job I've here, or one like it, I'd have surely failed.

"As it was, my first few weeks in this plant were nearly too much for me," Barron said seriously. "I sat up all night studying my plant problems more times than I'd care to tell you.

"Two and one-quarter tons of coal consumed to every one ton of corn distilled in making acetone—that was the situation when I came here. But since then, by utilizing exhaust steam until by making other plant changes, the management has dropped the consumption of coal to seven-eighths of a ton to one of corn.

"Other problems were quite as difficult. The men had to be patiently trained. What that meant you'll understand when I say that we have miles of steam pipes and that the best steam fitter might easily make serious mistakes and never depart one iota from standard practice.

"For the making of acetones and the by-product butyl is purely a germ proposition. It calls for a delicate distillation process, for pipes that are steam tight, for frequent flushing, thorough sterilizing, for care surpassing that of an expert dairyman handling sweet milk."

"And just what is acetone?" Barron was asked.

"It is a cordite solvent—a munition of war."

If ever on Trinity Street you might find it worth while to step into Barron's office. On the wall above a subordinate's desk and in full view of his, you would notice a score of simple clips holding work—orders for as many departments. He can tell at a glance whether work for any one or for all departments is at high ebb or low.

On the wall opposite his own desk are two or three large white-prints captioned "Late and Absent." No need to waste words on a delinquent; just show him his record.

But supposing you don't carry away an adaptable idea, you'll have met Frank W. Barron—a young man who has mastered the theory and practice of mechanical engineering, mastered both so well that he came back and made good.

Hanging to a Poor Old System

THERE is still a tendency to adhere to certain regulations regarding civic business that serve no other purpose than to be a nuisance. There was a case in point in an investigation that was being carried on in Toronto a few days ago. Here is the way in which it was reported:

> "Did you know that Miles Vokes' sons were selling to the board?"
>
> "I knew the British-American Hardware Company were selling. I spoke to Mr. Vokes about it, and he said, 'Hodgson, my position is clear. I have had legal advice, and am told that a joint stock company is quite legal.'"
>
> "You knew that Mr. Vokes' sons were the British-American Hardware Company?"
>
> "I knew nothing direct. It was only what I was told."
>
> "Don't you think it was a vicious principle?"
>
> "Not if they were the lowest tenderers."

Now, just where the vicious part of the system comes in, it is hard to understand as long as the whole work is let by tender, and the tenders are handled honestly and in public.

Civic regulations provide that men who sit on councils or commissions shall not sell to that body. What is the result? A capable man, one who might make a splendid public servant, keeps out of public life because he does not feel in a position to sacrifice his business.

There are instances all over the country where this same thing is working to very grave disadvantage. It is easy to imagine a case where there would be plenty of grafting were it possible to do the purchasing otherwise than by tender. But the public can be protected and well protected if the public tender system is used, and if these tenders are opened at a certain time in public. Publicity is in this case the safeguard, and it will also allow a man to serve his community without having to hang up a shingle saying, "I'm under suspicion because I am a member of the council."

CANADIAN MACHINERY learned that British Acetones, Toronto, Limited, manufacture seventy-five per cent. of all acetones made in Canada, and that a good deal of this remarkable success is owing to Colonel Gooderham's executive ability and long experience in the distillery business. For over two years he has given his plant and his personal services gratis to the British government.

MARKET DEVELOPMENTS

U.S. Government Stops Chance of Any Panic

War Contractors to be Treated Very Liberally and Given Every Opportunity to Get Back on Peace Lines Again—Should Be a Better Labor Market in Canada Now Than Before the War

EVERY precaution has been taken in United States against allowing the bottom to fall out of business by reason of the cancellation of contracts. It is only following the logical course of events that these should go by the boards in a short time following the cessation of hostilities, but it is of the utmost importance that the operation should be completed with the least possible derangement of the industrial fabric of the nation. Any movement that is taken in United States in this direction will certainly have a reflex influence on this country. The government will accept and pay for all materials finished at the time of cancellation, and will also buy all material in process at prices including a pro rata of profit. The term "material in process" will be interpreted liberally to include material secured for the purpose of filling the contract, even though no actual work has been done on it. This plan has been submitted to the leading holders of U.S. war contracts and they approve of it. It seems only reasonable that the same arrangement will be made with Canadian contractors who have unfinished contracts for the U.S. government.

The signing of the armistice has been the signal for a lot of neglected business to come prominently to the front. Railroad shops orders for machine tools are reported in generous quantities at U.S. points. This class of business has largely been denied access to the markets for some time past, and now that the war pressure is removed, there is likely to be considerable activity and renewed buying.

Industrial Canada faces its period of reconstruction right now. It has been anticipated in many cases, and firms have ambitious programs that should work out to good advantage if the proper support is forthcoming. Other firms were war favorites and nothing else, and they will simply drop out. Although there may have been little in the mechanical training a person received in a shell shop that would fit that person for machine work after, there is another side to the matter. Those who have worked for some years in shell shops have become accustomed to working to very fine dimensions. They have learned to do things within a ten thousandth of an inch of being absolutely correct, and this training is not going to be lost. The shell shop workers will carry a lot of it into other lines, and in that will come the benefit of providing Canada with a better labor market than she ever had before.

SUPPLIES WILL HANG OUT LONGEST

Will be Sold to War Trade as Long as There is a Shell to Be Turned

TORONTO.—Munition shops in Toronto started work on Tuesday morning as though there had been no cessation of war. Of course the management and those in the works know very well that it will be only a short time until these operations shall have ceased. There does not seem to be any tendency to adopt the guillotine method in cancelling these contracts, rather does it seem likely that they will be dropped as easily as possible, with a view to avoiding anything approaching a panicky feeling in the industrial or labor world. It is intimated that the policy of United States authorities will be to pay for all material in the process of manufacture, and to make readjustment on the basis of labor costs on material that is not needed. It is likely that the same treatment will be extended to shops in Canada handling American orders. It may be that before this reaches the readers a statement may have been sent out from Ottawa covering the case in full.

Dealers in Canada are not quite clear yet on some of the rulings that have been made at Washington regarding the placing of stock orders with firms on the other side of the line. The interpretation of the order made at Ottawa does not coincide with that at Washington in detail. In fact in a good many cases there has been quite a bit of confusion regarding priorities and licenses. Some of the larger dealers have found it necessary to institute and maintain a separate department to deal with these matters.

One of the dealers here expressed the view this morning that the day of the single-purpose machine had not passed with the end of the war contracts. "I believe that production machines in specialty work will be more than ever used in this country, and that to that extent they will replace the general purpose machine. The best results have been obtained where each operation in the shop is specialized."

This same dealer refused absolutely to believe any blue-ruin talk. On his desk were letters from four firms that had not in four years purchased a dollar's worth of equipment outside of war work machinery. They stated that they were desirous of information regarding certain lines of machinery that the dealer had practically gone out of for the period of the war.

The Supply Departments

Supplies for war shops will be the last to receive notice to quit. As long as there is a shell made it will be necessary to have supplies for the work. Some of the dealers here are fairly well stocked with this material. They are getting rid of it in fair style, however, and by the time the munition contracts are done for they will be pretty well squared away on the material that they had to purchase at war prices. War shops have been buying their supplies rather close for some weeks past so that there will not be any particular jar in this direction.

The Steel Stock

Most of the houses doing a warehouse business in steel are in good shape. That is they are fairly well cleaned out of material that has had a period of very high and inflated value during the period of war buying. In some cases, however, there are stocks held that will not be readily disposed of at prices that will clear the dealers. For instance, some places have a fairly large amount of nickel steel on hand. When munitions contracts and airplane building fall off the big demand for this in war work will be done for. It is used for automobile axles, but builders of cars are not likely to pay war prices for anything that will be sold in the after-war market. This opinion is simply based on presumption.

Dealers do not look for a slump in the price of the basic article, steel. They anticipate a higher level than is paid at U. S. points of production now.

There seemed to be a tendency all through the market to look for good business ahead. The trade is willing to admit that there may be a period of quiet trade, but the fact that the war is over and the Allies are more than conquerors is enough to counterbalance this many times over.

EVERY SAFEGUARD PLACED AROUND CANCELLATION OF THE WAR CONTRACTS

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Nov. 14.—Pig iron production in October fell off about 1.3 per cent. from the September rate and steel ingot production about 3.2 per cent. This is contrary to precedent, as October, with its favorable weather conditions, usually shows exceptionally heavy production rate. This year there were two special factors. In the first place September production was very heavy, showing a sharp gain over the August rate, while in the second place the influenza epidemic very considerably reduced working forces at blast furnaces and steel mills. The production of coke was materially reduced, but it appears that the blast furnaces suffered from depletion of working forces more than from shortage of coke.

The production of steel ingots in October was at the rate of about 45,250,000 gross tons a year, and that is in itself a favorable showing, comparing with actual outputs of about 43,700,000 tons in 1917 and 41,400,000 tons in 1916. Productive capacity, with all conditions favorable, is fully 47,000,000 tons a year, perhaps more, but in these war times conditions have not all been favorable. There has been some shortage of labor, and in a few cases inefficiency of labor, while there has been a shortage of good grades of scrap. The total tonnage of scrap has been fairly large, but it has run to the lighter grades, really standard heavy melting steel being in poor supply.

Cancellations of War Contracts

It goes without saying that the cessation of hostilities means a great decrease in the total amount of steel required for war and near-war purposes, and many contracts have to be canceled. Already there has been worked out a definite plan for such cancellations as may be necessary, to cover the case of contracts that do not carry their own cancellation terms, and the majority of contracts do not. The government will accept and pay for all material finished at the time of the cancellation, and will also buy all material in process, at prices including a pro rata of profit. The term material in process will be interpreted liberally, to include material secured for the purpose of filling the contract, even though no actual work has been done on it. This plan has been submitted to leading holders of contracts and meets their approval. The Government having purchased material of various sorts will be in position to sell it at the best price obtainable, as values will run under the new conditions, and in most cases the material will no doubt be sold back to the contractor. The government has established a board of military men to hear and adjust complaints under these contract cancellations, so as to avoid what would otherwise be tedious delays in adjustment.

The first cancellations will doubtless be of contracts for shell steel for the Allies, the next of contracts for shell steel for the government. At all times there is a large quantity of shell steel in transit and in process of manufacture, and even the instant cessation of all rolling of shell steel would allow for a large supply of shells for emergencies during the period between the cessation of hostilities and the final assurance of absolute peace.

Ship Steel

The Shipping Board continues working out its policy of retrenchment, but this is retrenchment in expenditures, the introduction of economies, rather than any material reduction in the quantity of ships to be built. Relations with inefficient yards will be discontinued, and various contemplated shipyard extensions have been abandoned. The program to build 15,000,000 tons deadweight of vessels, of which about 2,500,000 tons has been completed, is left intact.

To the steel trade, especially as regards conditions during the next few months, the important item is a decision not yet officially announced, but quite well known in the steel circles immediately involved. That is, to reduce the weekly quota of ship plates called for to been held to a schedule of 50,000 net an amount not exceeding the quantity of plates that is at the same time actually passing into vessel hulls. This will effect a reduction in weekly deliveries of plates of from 30 to 50 per cent. For several months past the plate mills have tons weekly of plates for account of the Fleet Corporation. This would cover approximately 700,000 tons deadweight of steel shipbuilding per month. The actual average of steel hull launchings in the past few months has only been between 300,000 and 400,000 tons. As a consequence, plates have accumulated. There must be a large tonnage in transit and in course of fabrication, but the accumulation apart from that is now understood to be about a million tons. When it was important, regardless of expense, to complete every vessel possible, it was right to have a surplus at every point along the line, even though shortage in some particular retarded the use of the material or facilities. Thus the "bottle neck" for months past has been the supply of engines, boilers and other appurtenances. Now, when money must not be spent so lavishly, these extreme factors of safety are not desirable. Hence plate deliveries are shortly to be curtailed, so that there will be no further accumulation, and the present accumulation may even be reduced. The reduction, however, will only be temporary, as Director General of Shipbuilding Schwab has just stated that the present objective is 700,000 tons deadweight of vessels per month, and this rate is expected to be reached next Spring. That rate, or even a greater rate, will be continued for a long time when once it is attained. The rate would require about 50,000 net tons of plates a week, the quota recently in force, so that the former rate of deliveries is eventually to be restored. Meanwhile, there will be more plates for other purposes. Foreign buyers are keen to secure plates and there are indications that they are ready to pay very high prices, above the present Government limits. It appears even that some such purchases have been made. Plates in the domestic market, on the other hand, are expected to rule at less than the present level.

Price Control

The War Industries Board is making progress in its plans for continuing control of industry after the war. Its life is assured to the President's proclamation of peace, which will necessarily be months hence, but legislation is to be sought covering a further period of six months. This plan meets with general approval among iron and steel manufacturers, who expect that without such control there would be a period of light demand, while the market finds itself for extended period of prosperity that nearly all expect to follow the war. In that period the market would presumably slump to a level far below that subsequently to be established, and this would cause disorganization.

There are some iron and steel manufacturers, however, who apparently would prefer the slump. Doubtless their idea is that there is so much to be done by way of reducing costs that a period of slackness would be useful in helping this cost readjustment. They are thinking of wage rates among other items, but it is really doubtful whether wages can be reduced much, if at all. A couple of years or so ago the trade was almost a unit in expecting, and desiring, a general "shake-out" after the war, to get costs down, believing this to be imperatively necessary, but a great many have changed their minds meanwhile, and expect wages, commodity prices and practically everything to continue on a much higher level after the war than obtained before, probably for years afterwards and perhaps for an indefinite time.

RAILWAY SHOPS COME IN THE MARKET

Will Do a Lot of Buying Now in Order to Catch Up With Repair Work

Special to CANADIAN MACHINERY

NEW YORK, November 13.—The topic of all-absorbing interest in the machinery industry to-day is the effect that the end of the war will have upon orders for machinery to be utilized in the manufacture of war munitions. In a general way the government is relied upon to prevent any hardship being visited upon either manufacturers or dealers in machinery. In the Eastern territory last week there was evidence of a conservative feeling and of the holding back of prospective orders for machine tools that were expected to be needed for the additional manufacture of guns, shells, small arms and other war munitions.

Thus far the most of the cancellation of orders for machine tools have come from shipbuilding concerns and most of these resulted from the abandonment of the Alameda ship plant by the Emergency Fleet Corp. Cancellation of machine tool orders have been guarded against by provisos in contracts placed during the last six months or a year, stipulating that one third or one-half of the order be paid for in cash upon acceptance of the contract and the balance of the purchase price be subject to sight draft against bill of lading. Such contracts were entered into, however, only with untried interests, this precaution not being considered necessary in dealings with regular customers with stable lines of manufacture. Not a few contracts were recently written with a non-cancellation clause. This form of contract has been quite generally adopted in the last month.

On the other hand a few large manufacturers of machinery have taken a stand against the non-cancellation clause, believing that as the government is practically the source of all work for which machinery has been purchased, that satisfactory arrangements will be made covering the period of reconstruction.

Upon the cancellation of contracts for troop ships, made by the Emergency Fleet Corporation with the Bethlehem Steel and the New York Shipbuilding Corporations, it was ordered that work on machinery for these government yards be suspended. This order, however, applied only to equipment upon which manufacture had not yet been commenced. It is now understood that the Fleet Corporation has called upon each machinery contractor to report the exact status of machinery orders at his plant.

It is understood that the twelve-inch howitzer plant planned for construction at Nicetown, Pa., by the Midvale Steel and Ordnance Co. will not be built. No action has been taken toward the purchase of tools for the manufacture of pistols under recent contracts, and no orders for machine tools have been placed for the additional machine shop at the Charlestown, Mass., Navy Yard, which, with equipment, was to cost $900,000. It is expected also that the $1,000,000 list of tools for the Osgood, Bradley Car Co., Worcester, Mass., will be withdrawn.

Railroads, however, have been buying machinery more actively in the last week and are expected to continue placing important orders for shop equipment. The Pennsylvania R. R. is buying tools for its locomotive repair shop now being built at Marietta, Pa. The New York Central is placing orders for cranes for its East Buffalo car shops. The Baltimore and Ohio has also bought tools; other railroads have put out inquiries for machinery, including forging machines, which will probably be purchased for 1919 delivery. The Pennsylvania R. R. will spend about $1,000,000 for building and equipping repair shops in South Philadelphia.

SERVICE FLAGS IN THE DUNDAS SHOPS

There was no great stimulus required in the plant of the Bertram Company in Dundas to put them over the top in the Victory Loan campaign. The payments on the last loan had just been completed on the company's extended payment plan, and the receipt of these documents just on the eve of the present loan had a very good effect in bringing home the real value of the proposition. The company used a large envelope, printed in red, to deliver the paid-up bonds, and also to solicit subscriptions to the new issue. The envelope stated, "This is YOUR Victory Bond, bought and paid for out of your weekly earnings. Perhaps the payments pinched you sometimes, but—would you have made this saving if you had not subscribed for this bond? You have shown yourself what you can do. You are again offered the same opportunity to save systematically."

The publicity was well attended to. T. Stevenson, from the Trades Council, Toronto, was secured to address the men, and he put the case in a very plain and pointed way and made a good impression. When a representative of CANADIAN MACHINERY was at the Bertram plant a few days ago there were service flags proudly displayed in a good many of the departments. The sum of $150,000 was the total subscription. The company needed 813 subscribers to get a service flag, and the total a few days ago was 940. In fact the Bertram plant is pretty close to 100 per cent. in the matter of the number subscribing.

In the Pratt & Whitney plant, which is just across the road from the Bertram plant, the same good success was met with in the search for purchasers of Victory bonds. There were several rather amusing events here. The company had eighty-two men on the roll, and there were eighty-four applications taken in. The explanation was given that two men had been taken on since the census was taken. There are also two boys in the office at this plant that have at an early age developed the financing instinct to quite a degree. These lads made the proposition that if their wages were increased they would gladly subscribe to the Victory Loan fund. Pratt & Whitney won their flag in short order.

HOW WELLAND WENT AFTER THE BIG LOAN

The following tables show the records made last week by Welland's industries. Up to noon last Saturday ten plants exceeded their quotas and work is still progressing in all the plants.

The following industries have exceeded their quota by the percentages shown: Volta Company, 145 per cent.; Electric Steel & Metals, 117 per cent.; Electro Metals, 95 per cent.; John Deere, 73 per cent.; Canadian Billings Spencer, 75 per cent.; Union Carbide, 69 per cent.; Plymouth Cordage, 58 per cent.; M. Beatty & Sons, 50 per cent.; Chipman Holton, 46 per cent.; Canadian Steel Foundries, 8 per cent.; Empire Cotton Mills, 5 per cent.

The following percentages show amount of quota raised by these plants: Page Hersey, 94 per cent.; Welland Machine & Foundries, 93 per cent.; Shipbuilding Company, 75 per cent., and Metals Chemicas, 70 per cent.

100 Per Cent. Industries

Every employee in the following plants have bought bonds: Canadian Forge, John Deere, Electric Steel & Metals, Empire Cotton Mills, Union Carbide, Volta Mfg. Company.

Up to Saturday noon the following amounts were raised in the factories named:

Electro Metals	$117,000
Canada Forge	105,000
Union Carbide	76,400
Canadian Steel Foundries	75,850
Empire Cotton Mills	57,000
Plymouth Cordage	47,500
Canadian Billings & Spencer	47,400
Page Hersey	41,650
Shipbuilding Company	38,000
Electric Steel & Metals	31.300
John Deere Mfg. Company	17,100
Beatty & Sons	15,600
Metals Chemicals	10.250
Volta Mfg. Company	8,800
Welland Machine	6.000
Knitting Company	3,700
	$698,550

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 31 00	$ 29 50
Electro copper	31 00	29 50
Castings, copper	30 50	28 50
Tin	90 00	95 00
Spelter	10 50	11 00
Lead	10 50	10 00
Antimony	15 00	18 00
Aluminum	46 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$10 00	$10 00
Tank plates, 3-16 in.	10 50	10 10

WROUGHT PIPE

Price List No. 37

Standard Buttweld

Per 100 feet	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	30 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers ... List plus	20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 ... add	20
Machine screws, o. and fil. hd. brass ... add	25
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 burra, list plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws ...	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ... plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws ... list plus	20
Collar screws ... list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ... add 40,	10
Cold pressed nuts to 1½ in. ... add	$4 50
Cold pressed nuts over 1½ in. ... add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright	9 50	10 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.	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White. Cts. per lb.

XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

Colored.

Lion	15	Popular	12
Standard	18½	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	57 00	46 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	...
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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CANADIAN MACHINERY AND MANUFACTURING NEWS

Volume XX. No. 21 November 21, 1918

Conciliation Will Do Much To Solve Problem

Imperial Munitions Board Let Some of the Contracts Run to Ease Labor Situation—Minister of Labor Sees No Cause to Anticipate Trouble in Handling the Situation

Special to CANADIAN MACHINERY

OTTAWA, November 19.—Ottawa's not the same old Ottawa that it used to be. There's too much business being carried on here to permit of the old political atmosphere thriving and having full fling. The ward heeler is not cutting much ice in the capital just now, although his day may come again. But the people who are here and who get the hearing are the men who are in touch with business, who have much to do with the employment of labor, who are planning how best to pilot their several concerns from the war-time trade to the basis of peace-time work. Of course it's all a little rough on the old-time politician, but it's a fact, and for the present chapter his likes or dislikes are not of very serious consequence.

As far as CANADIAN MACHINERY can find out, the matter of after-the-war trade has been put right in the centre of the ring. It has preference over everything. In fact its rating on the basis of priorities is A1. Men are discussing it. It's the talk at the Chateau, in the government offices, and in the inner chambers as well. So if talking and discussing are going to settle the after-war problems they will be polished and turned until they dazzle. As a matter of fact the great "What next" chapter is the centre of all interest. Anything else that gets a chance simply flies off on a tangent.

Stopping the Orders

CANADIAN MACHINERY learns that the extension of British orders after the cessation of war was largely out of consideration for the men employed in the works, and partly from a desire to avoid dumping thousands into the labor market at once. The Munitions Board do not want the shells. That is pretty generally understood. Some weeks ago—in fact at various times—they have drawn the attention of the government that the day was coming when they would not give out any more orders, and they have urged the government to look forward to that time, and guard against it. So it is that at the present time the Imperial Munitions Board is in the position of the purchaser buying clothes that he will not wear, or of the householder loading up his larder with food that he will not need. Poor business, you say? Yes, it is, and the chances are that the head of the Imperial Munitions Board would not be inclined to dispute the point. He knows a real business deal about as thoroughly as any man in Canada, and if the matter were looked at from that slant alone the contracts would probably have been cancelled the day the armistice was signed.

The Other Side

Several other ways were considered. It was suggested at one time that the munitions workers should be given a bonus of a couple of weeks' pay in lieu of any notice that their services were no longer required. There were objections to this plan as it was felt that there would be an inevitable glutting of certain labor markets, and it was decided to make every effort to avoid this, so the plan, which meets with the approval of Sir Joseph Flavelle, was brought out, of giving contracts until the 14th of December to run. That was coupled with instructions not to take any new material into the works after Friday night, the 15th. Those in the rough turning would thus be let out first, probably about ten per cent. of the force.

Not Likely to Continue

The suggestion has been made here that the Imperial Munitions Board should continue in office. They have a splendid organization that has produced results that the country hardly appreciates, and if it did understand their work better it might add to the size and insistence of the request that they continue in office. When questioned on this point Sir Joseph simply remarked that the work now before the Imperial Munitions Board was to liquidate as quickly as possible. "We were brought into existence to perform a stated work. That has been done, and as soon as possible we will cease to exist." That apparently is the feeling of the chairman. When on this subject it might be worth while to give the opinion of a prominent Canadian manufacturer who was in Ottawa within the last few days. The manufacturer in question stated that he was going to tell Sir Joseph personally the same thing. Speaking to your correspondent he said: "Our firm has a great deal to thank the Imperial Munitions Board for. I have gone to the chairman several times with propositions that I couldn't see daylight through and I have never come away without the solution of my trouble or something pretty close to it. I believe that I should give credit for the assistance that we have received in this way."

Absorbing Labor

The Imperial Munitions Board had a request from a lumbering concern in the north asking if that board had any objections now to its taking men from shell shops for bush work. The Board replied by wire that if the lumber concern were able to do this they would be helping very materially in bringing about the very end that the Imperial Munitions organization has in sight.

American Contracts

While the British business is done for—or at least will be within a few days or weeks—there is not such certainty about the termination of some of the American contracts. The production of the 240 mm. shell may be continued.

The guns for these shells are being turned out now in United States shops; the Motor Trucks Ltd., of Brantford, have a contract for 250,000 of these shells. The shell differs from the old 9.2 as it has quite a taper from about half way up the body. The U. S. government wants these shells, and it may be that firms holding these contracts will be making shells when the business in other centres may have become simply a memory of good wages and quantity production. Of course there's nothing official about this, but it looks probable.

J. B. Detwiler, president of Motor Trucks, was at the Chateau for a day or so at the week-end. He went from here to confer with some of the directors in New York City, and it may be that something definite will be announced shortly.

Motor Trucks have a large shop in Brantford, and it may continue after the war work is done. CANADIAN MACHINERY discussed this point with Mr. Detwiler. "We have a shop there that is certainly something more than a shell shop," he stated. "It is 700 x 90 feet, and it was finished in 45 days from the breaking of ground. It is a steel structure and fitted for other lines than the production of shells. I am not able to state just what lines I refer to, but we have plans that are fairly well advanced in this direction. Production has been held back with delays in installing equipment, and more especially with power shortage. We are equipped for group motor drive, and it is only recently that we have been able to secure anything like sufficient power for some of the heavy initial operations."

The Position of Labor

The next few months is likely to require a considerable amount of common sense on the part of both employers and employees. CANADIAN MACHINERY can state definitely that the Labor Department does not anticipate trouble if this condition can be brought about, and there are many indications that point to it as a real likelihood. Senator Robertson, the newly appointed Minister of Labor, has a grasp of the situation. He came from the ranks of organized labor, and it does not require much conversation with him to impress upon one the fact that he sizes up like a good go-between for both capital and labor. He discussed the situation at some length with CANADIAN MACHINERY, and his views are those of a man who has been a keen student of the situation, well versed in the contributory causes to trouble and their cure, and firm enough to have a solution for them.

"I have no reason to anticipate serious trouble, although we realize that the demobilization of the army, following hard upon the cancellation of war contracts, is going to give the country a real problem to deal with. Against that I am firmly convinced that we have a more conciliatory spirit on the part of both employers and employees than has been the case for some time past. The employer of to-day, especially the younger generation, realizes in a very direct way that they have a greater responsibility to the man in their shops than simply to extract a day's work from him, and the men are coming to see that their success is very closely connected with the success of their employer. Then there is the softening influence of the war. It has played its part. It may not be apparent on the surface, but it is there, and it is going to be felt.

The Demobilization Plan

"The manner in which the army is going to be demobilized is going to prevent, as far as possible, the congesting of the labor market in any one particular section. For instance if you take ten thousand British Columbia men and put them back in British Columbia, and ten thousand Alberta men in Alberta, and so on, you are going to have a much more equal distribution than had you taken that ten thousand and unloaded them at some of the ports, either at Halifax or Quebec.

"If there is going to be a pinch it will probably come in the first four months of the year. We are facing a situation where, above all else, we have a right to demand from all classes, moderation, and a large measure of conciliation. Give us that, and we have little to fear."

Officials in close touch with the Labor Department believe that a lot of foreigners will be leaving Canada very shortly. One of them put the case to CANADIAN MACHINERY this way: "As soon as an Italian gets about $2,000 in his belt he buys a ticket and goes back to Italy, and he is fairly well fixed for some time to come. These men have not been able to get back for some time, and when I refer to that I mean others than Italians. They have in many cases during the last four years made more money than they ever dreamed was possible. As soon as shipping is available they are going to leave. They will take quite a lot of money with them, but lying in their money belt is equivalent to having it withdrawn from circulation. So my parting word to them would simply be, "We'll never stop you."

MASSEY-HARRIS WANT 100 MOLDERS, THEN 1,000 MEN

THAT the securing of one hundred molders right now means the employing of 1,000 men in the shops of the Massey-Harris Company is the information given out there to-day. The Massey-Harris Company is starting an advertising campaign to secure these men. They are using space liberally. Here are some of the advertising notices that state the case from the company's point of view:

Food For Thought!

What does the future hold for you, Mr. Worker? Why worry when prompt action may get you a steady position in the largest peace industry in Canada?

MASSEY-HARRIS CO., LTD.

Notice To Factory Workers

Now that peace is in sight you will wish to consider permanent employment. Never has the demand for food been so urgent. Why not help us to increase production by working in the Massey-Harris factories? Ideal working conditions.

Massey-Harris Co. still have room for more molders as the demand for implements is urgent. Why not secure steady work at the highest wages while you still have the opportunity?

Mr. Gifford, superintendent of the Toronto plant, in discussing the matter with CANADIAN MACHINERY, stated that their policy would be to keep up the wages as long as possible, and so secure the cream of the men that would be desiring employment. "A few men dropping in and asking for work in the last few days is the first sunshine that we've seen in a long time," he stated. Ten of their old molders are back with them again.

In some cases molders have quit their trades and entered war contract shops for the higher wages that were being paid there. In that they have acquired a liking for machine operations, and seek them when they apply at places like Massey-Harris. However the chance of making around $6 per day, with steady employment, is quite a factor in making them molders again.

Officials at the plant stated that there was a tendency on the part of some who had been laborers before to hold out for something better because they have been making big money in munitions plants, and they do not like to fall back to the laborer's rate of pay. The prospects of steady work through the winter have considerable to do with a decision, though.

Hamilton Industries In Good Shape For It

Interviews With Large Number of the Industrial Leaders Gives Reason to Hope For Continued Employment—How War Shops Are Turning to Other Lines Now

Special to CANADIAN MACHINERY

HAMILTON, Nov. 19.—The forecasts made by economists that a period of industrial depression was bound to follow quickly on the heels of the termination of the European conflict, are not going to materialize so far as the numerous large industrials of Hamilton are concerned.

Not that the heads of these concerns think there will not be a period of grave re-adjustment to be carefully weathered. But they are prepared for the transition that must soon come, and ventured the opinion collectively that there would be enough foreign orders to keep the wheels of industry humming for many months to come, to say nothing of the large volume of domestic business which is looked for.

Shut-downs are not looked for at all, and while in a few isolated cases war workers may be thrown upon the country for a short time, and the reduction of the Canadian army may do likewise, Hamilton manufacturers rather lean to the opinion that all this available labor will be absorbed quickly.

It was frankly admitted by several of the more prominent manufacturers that the Imperial Munitions Board would in all likelihood entirely cancel its contracts within the next few days, but no alarm is felt at that, because, as has been mentioned, all preparations for placing factories on a peace basis have already been made. Nor does this imply that wages will decrease. The labor market is still acute and is likely to remain so for some time to come. More than a few Hamilton industrials reported that they could all do with two and three hundred more men each, and were willing to pay current wages. Die sinkers and machinists are most in demand.

As for foreign business, there appears to be plenty of it in sight. A heavy demand has been created for machine tools in foreign countries, all the belligerent nations included. Much rollink stock is also wanted, while South American nations have placed large orders for agricultural implements with four Hamilton concerns.

It might be said here that the labor market is causing concern if anything. Many manufacturers predict that once the present scarcity of shipping is relieved—as they expect it will be another twelve-month hence—hundreds of foreigners who worked steadily during the four years of war for the highest wages they ever earned in their lives, will flock to their native lands with pockets filled with gold. The question which causes worry is: "From where will albor be recruited to make up for this shortage?" Meanwhile, there is every promise that Hamilton, industrially speaking, will pass through the period of readjustment without any depression. Fully thirty or thirty-five thousand industrial workers are engaged at the present time, and this huge force will be increased if anything.

An individual canvass of the larger industries tends strongly to confirm the general viewpoint. Especially large orders for all kinds of equipment have been received from Belgium and France, and now that the submarine menace has ceased, export business will gradually revert back to normal, and orders which have not been delivered on this account will now be forwarded.

The largest industry in Hamilton is the Steel Company of Canada, which employs 2,900 men, and which has been working steadily on war work since the outbreak of hostilities. The company's contracts with the Imperial Munitions Board would ensure it remaining on war work for many months to come, but it is felt that these contracts will doubtless be cancelled at an early date. Loss of this work will cause not even a temporary lull in the operations of this plant. Francis H. Whitton, general manager, stated that, while the company was necessarily uncertain at present as to how much longer it would continue to produce war material, there was no uncertainty regarding future orders.

Much Depends On Railways

"We are working on war orders at full blast at the present time. If the war work is stopped we will revert to our other orders which include equipment for foreign countries. We have considerable domestic business in sight also," stated Mr. Whitton, who added that the railways were all in need of rolling stock, which meant heavy castings, etc., while the government would no doubt start many public works. Mr. Whitton said it was imperative to the stability of conditions in Canada that railways keep things moving. If transportation was not adequate to the new demands then it would be very difficult for large industrials to carry out their programmes.

Mr. Whitton pinned great faith in the ability of the Canadian Trade Commission to procure much foreign business for Canadian manufacturers while it is abroad. He thought that if manufacturers were prepared for the readjustment this commission would see to it that they got all the orders they could handle for months to come.

Mr. Whitton made it clear, however, that no one really knew just what the future held. Many broad questions were involved; but summing the situation up, by and large, he thought it was very promising.

As regards the probable demand for machine tools, Mr. Whitton said the Steel Company of Canada was not purchasing any at the present time. This company is not likely to scrap its munitions machinery.

At The Westinghouse Plant

Paul J. Myler, president of the Canadian Westinghouse Company, which has worked extensively on munitions, when asked what the outlook for his company was, was inclined to be non-commital as he said he was not in a position to talk. Mr. Myler did say, however, that the company had sufficient American orders for electrical equipment to keep it going for the next four months. About twenty per cent. of the output of the company is destined for the American markets in normal times, and no uneasiness is felt. As for the equipment which had been used in the making of munitions, Mr. Myler stated emphatically that none of it would have to be scrapped as it was adapted for such work.

War End Makes No Difference

Although it has worked exclusively on munitions since the outbreak of war the cancellation of such orders will have no effect on the Tallman Brass & Metal Company, and work will continue as usual.

Addison H. Tallman, manager of the company, said that if anything conditions in the immediate future would be better than ever. "We do not look forward to experiencing the slightest difficulty during the readjustment period. There might be a temporary hold-up, but that is extremely unlikely. We have large orders on hand which were held up owing to the shortage of certain material. The ending of hostilities will enable us to get these materials and then we shall proceed with our new business. Our new orders are both domestic and foreign. We expect to be soon able to resume our export trade in brass lines to Australia, Siam and South America. We certainly will not close our plant."

Will Make Steel Barrels

Otto W. Cook, manager of the Canadian Cartridge Company, stated that the end of the war would not affect his company in the slightest degree. One of the largest makers of munitions in Canada, this concern has lost no time in preparing for the period of readjustment, and will divert its efforts into a new channel entirely. Believing that a large market is open in Canada, the United States and other countries for steel barrels the Canadian Cartridge Company has erected a new $100,000 addition to its plant for this purpose and will commence making these barrels early in December. This company will be the only one in Canada to make steel barrels, and the present staff, engaged on munitions, will all be absorbed when the new work is taken up.

"We do not expect the slightest lull in operations. By the time we clean up our munition work we shall be able to proceed with the manufacture of barrels," said Mr. Cook, who added that machinery for the new work was arriving every day.

Men Are Wanted Here

Officials of the National Steel Car Company were very hopeful regarding the future. They said that they had plenty of business in sight and were not worrying in the least at the possible early cessation of munition making.

B. A. Hamilton, works manager of the company, said that the new orders the company had received were chiefly for rolling stock for the Canadian Government and the Malay and Indian governments. One thousand cars alone would be made for Canadian railways controlled by the government. Increased business was anticipated as a result of the visit to Europe of T. E. McAllister, president of the company, who recently returned. The company also thought that the Canadian Trade Commission would be very hopeful to Canadian industrials.

"We are badly in need of more labor, and can use three or four hundred more men and ensure them steady employment for several months to come. We principally want die-sinkers, machinists and car builders," concluded Mr. Hamilton.

At Dominion Foundries

Officials of the Dominion Foundries & Steel were not in a position to say just what the future activities of the company would be. The making of shell castings had occupied the company's attentions for the past four years, but plenty of new work was in sight, chiefly heavy castings and forgings. No shut-down is anticipated.

Not On War Work

Walter B. Champ, secretary-treasurer of the Hamilton Bridge Works Company, said that large orders for shipbuilding material, principally angle-iron, etc., would keep the company busy for many months to come.

"We have large orders for this material from the United States to enable it to carry out its large shipping programme. We also have many orders for construction steel and iron. The company never engaged in war work, strictly speaking, and therefore will not be affected during the readjustment period," said Mr. Champ.

Plenty of Orders

Col. Arthur F. Hatch, general manager of the Canada Steel Goods Company, was optimistic regarding the outlook in general. He hazarded the opinion that two years hence Canada would be the most prosperous country in the world. "Any country that can produce the grain we can, does not need to worry about the future. As for our own company we have plenty of orders on hand. There is always a demand for steel goods, consequently we do not look for any lull in production. We have many foreign and domestic orders."

Tonnage Will Help

C. R. Brown, secretary of the Canadian Drawn Steel Company, said that his company was in good shape. The output of this concern is chiefly agricultural implements and also equipment for shipbuilding concerns. These oredrs will keep the company busily engaged for several months to come, and are destined for Canadian points. Mr. Brown said that the company always did a large export trade until the scarcity of shipping prevented further activity. With the tonnage growing better all the time he said the company's export trade would not only come back to normal, but would doubtless increase, as it was out for all the foreign business it could get.

Officials of the Otis-Fensom Elevator Company, which has worked almost exclusively on munitions during the war, declined to make any statements regarding the industrial outlook of the company, as they said they thought the present time was not opportune for forecasts.

No Trouble Here

A. L. Page, general manager of the Frost Wire Fence Company, stated that his concern has been, and will be, engaged solely on the producing of agricultural equipment and farm requirements. Mr. Page said that the company, having never engaged in war work, did not contemplate any difficulty in passing through the period of readjustment, as it had plenty of orders on hand.

Want Farm Machinery

The Oliver Chilled Plow Company, which also has not engaged in war work, has plenty of export orders on hand to keep it going for a long while to come. Great demands for tractors have come from South America, Australia and Western Canada. Gang plows and all other forms of agricultural equipment are in demand also. "We have plenty of orders on hand for this equipment from South Africa, Great Britain, and other countries already mentioned," said Albert C. Dann, superintendent. This company is also eager to engage many additional workmen. Bench hands, assemblers, forge hands, etc., are wanted.

Busy at International

H. H. Biggert, superintendent of the International Harvester Company, stated that the company had orders for agricultural equipment that would keep it going for the next twelve months, and with the return of conditions to normal, orders would no doubt be increased.

"We have much business for New Zealand, Australia, Great Britain, South America and Italy. We are going full force at the present time and unless something unforeseen happens will continue so for some time to come. There is no possibility of this plant closing down. Every man we have will be kept busy," concluded Mr. Biggert.

Orders of Machine Tools

Regarding the likelihood of a demand for machine tools, officials of the Ford-Smith Machine Company stated that they were figuring on a large demand for this class of work from the foreign markets. The current demand of the domestic market might slacken for a time; but there was no doubt in their minds that much of the munition equipment would have to be scrapped. Most of it was worn out anyway, it was said.

"We have large orders for machine tools from all the belligerent countries," said an official.

LONDON SHOPS READY

Geo. White & Sons Co. Have Lines in Shape—Concrete Machines For Export Trade.

LONDON, Ont., Nov. 21—George White & Sons Company, Limited, and employees, of London, have subscribed $75,000 to the fifth Victory Loan which has just closed. Arthur W. White, vice-president and manager, has been the efficient chairman of the industrial committee of the London Victory Loan organization and to his leadership a great deal of the success of the work among the factories has been due. The canvass was handled by the company, the work being done in the various departments by the different foremen. F. J. White, secretary and sales manager, and E. A. White, treasurer, had charge of the canvass among the office employees. John Vasbinder, superintendent, assisted the foremen in their work. Following are the names of the department heads who did good work among the employees in the canvass: Harry Williams, machinists; William Wood, foundry; John Fryer, boiler department; William Elliott, and William Cooper, woodworking department; William Mason, wheel department; Frank Meanley, engine erecting department.

After-War Conditions

Arthur White says in reference to the conditions of the near future, that his firm is ready to start full blast on the manufacture of farm machinery as soon as it is possible to secure sufficient supplies of raw materials. He anticipates that his company will have a full supply of gasoline and steam tractors, and threshing machines ready for next year's trade which he thinks will be unusually heavy.

He intends going after the tractor trade as he sees a great opportunity in it. The tractor is here to stay and it will not be long until it will be as common as the automobile. The steam tractor is still holding its own with the gasoline tractor, and Mr. White thinks that it will be in good demand.

Export trade is being considered by the company, but it is the intention to supply the home market first. It is anticipated that this market will be so heavy that it will be nearly impossible to supply any goods for export.

Prospects Are Bright

"Prospects are bright for a heavy trade in our line at least," said H. Pocock, president of the London Concrete Machinery Company, to the CANADIAN MACHINERY AND MANUFACTURING NEWS recently in reference to the outlook for business following the war. "Our business has kept up throughout the four years of war and for the first fifteen days of November it has been double that of the corresponding period in any other year. September and October of this year we did the largest business of any corresponding months in any other years."

The London Concrete Machinery Company, H. Pocock, president; J. C. Doidge, vice-president, manufactures concrete mixers of all sizes, and it has recently undertaken to distribute the Novo dust-proof and frost-proof gasoline engines for Canada. This is the engine that is now being put out with the concrete mixers. It is made by the Novo Engine Company, of Lansing, Michigan. It is a vertical engine and all its working parts are enclosed in oil. The manufacturers assert that this feature enables it to give service for three times as long as the ordinary open type engine. It is also lighter in weight per rated h.p. than theh ordinary gasoline engine.

The Export Trade

An order recently has been received by the company for two carloads of cement mixers to be shipped to Australia, two carloads to South Africa, and one car to New Zealand. The company is busy on these orders now.

This company is already making plans to capture some of the export trade in France as it is thought that the demand for its goods will be large there for the next few years. It will have an exhibit of concrete mixers at the Lyons fair which will be held in France in March. Several sizes of mixers suitable for building construction will be exhibited.

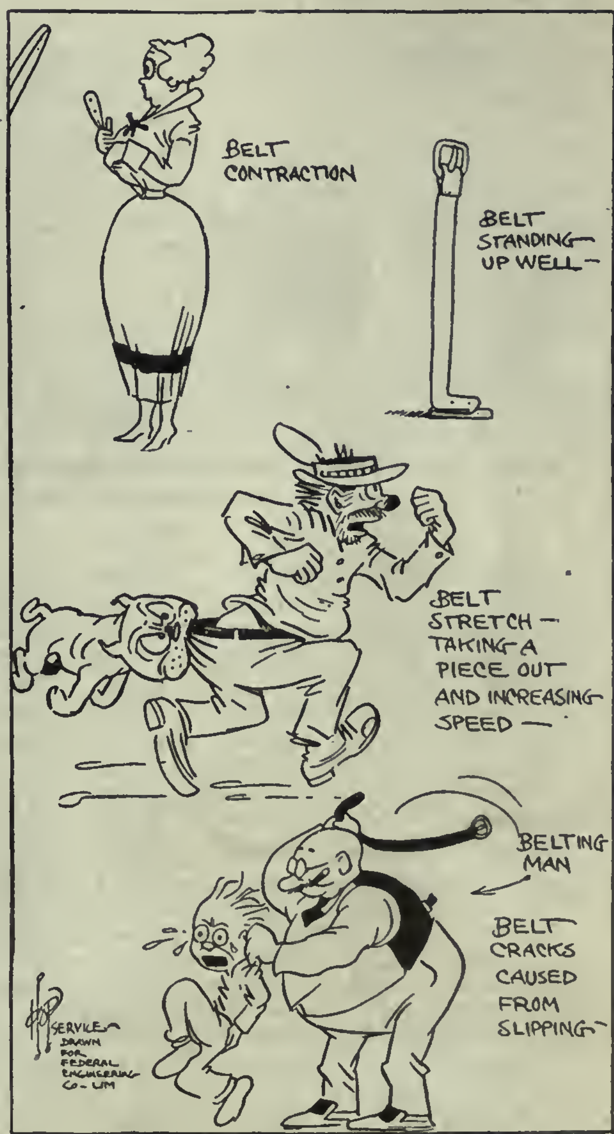
Mr. Pocock has no fears for the future of Canada as he thinks the export trade will enable the wheels of industrialism to keep revolving at a sufficient speed to preserve the present prosperity and in time increase it.

WELLAND PLANT IS O.K.

Steel and Metals is in Shape to Manufacture Mining Machinery Now.

WELLAND, Nov. 21—The Electric Steel and Metals, Welland, are actively contemplating the manufacture of mining machinery and other products of like nature. Unlike many plants engaged on war work, this company's equipment is admirably adapted to peace needs. The electric furnace installation and the structure in which the furnaces are located were erected in 1913 to serve the strictly commercial purpose of making steel castings and no change in equipment was needed to adapt the plant to the casting of steel shell billets. On teh coming of peace a few days' preparation will suffice to change from a war to a peace basis and the buildings since erected for shell turning have been built to serve the purpose of a permanent machine shop.

In conversation with a representative of CANADIAN MACHINERY Mr. E. Carnegie, president and general manager, expressed the opinion that Canadian manufacturers have reason to be very optimistic over future business conditions and that a little thought and foresight now would be amply repaid in the permanent prosperity to come.



—Courtesy of Belts.

BELT TERMS DEFINED.

British Cost Is Away Below This Country's

Figures Secured Shows That the Shipbuilding Industry in Canada is Up Against a Very Hard Competition by Reason of the Difference in Wages and Cost of Material

Special to CANADIAN MACHINERY

OTTAWA, November 20.—Under the programme of Canadian shipbuilding authorized by order-in-council last March fifty-five million dollars was to be expended. Up to the date of this article the contracts authorized may be summarized as follows:

Lake type	9	vessels
4,300 ton type	6	"
5,100 " "	8	"
8,100 " "	14	"
10,500 " "	2	"
	39	

As mentioned by Sir Joseph Flavelle in an interview given to this paper this week, the policy of the Imperial Munitions Board will be to push its shipbuilding activities to the limit, and as soon as the berths occupied by the Board's vesseds are cleared they will be occupied by ships to be constructed under the Canadian Government programme.

For some time to come the government work will keep all the yards fully occupied. From the very first the Marine Department has been opposed to the increasing of the establishment of new yards. The steel available has not been sufficient to keep existing yards fully occupied, and the Department felt that the best policy was to keep existing yards occupied to their full capacity rather than to increase the number of yards when, owing to the scarcity of labor and material, they would not be running full time. It was also felt that if at any time in future construction should decline, the same thing would apply

The Matter of Price

The prospects for the future largely depend on how far we in Canada can go in the direction of building ships within measurable distance of what they can be built for in the United Kingdom. This applies to the future of shipbuilding in the United States also, because at the present time prices in the Canadian yards compare most favorably with the prices for ships of the same type in American yards.

At present, ships built in Canada are costing about double what they cost in the United Kingdom. This is due to the high cost of material which, in turn, is due to the high cost of labor, mainly.

Steel plates have been available to builders in Great Britain at a price of, approximately, fifty-five dollars a ton. Compare that with the following schedule, showing the delivered cost of steel per long ton from Pittsburg and Chicago to different points in Canada:

From Pittsburg to	Cost per long ton
Vancouver, Victoria and Prince Rupert	$102.25
Port Arthur	89.37
Toronto	78.84
Collingwood	80.19
Montreal	96.89
Three Rivers	81.87
Quebec	81.87
Halifax	84.67
From Chicago to	**Cost per long ton**
Vancouver, Victoria and Prince Rupert	$100.80
Port Arthur	82 32
Toronto	79.29
Collingwood	81.08
Montreal	99.68
Three Rivers	84.78
Quebec	84.78
Halifax	87.36

So much for the relative cost of materials with ourselves and our great competitors. The next factor is the cost of labor in the shipyards. The following are the wages paid per week to the different classes of shipyard workers in Great Britain and in different points in Canada:

Wages Per Week to Shipyard Workers in Great Britain and Canada, With Per Cent. Increase in Canada Over Great Britain

Trades—	England 50 hrs.	Montreal 50 hrs.	% Inc.	Pt. Arthur 50 hrs.	% Inc.	Pac. Coast 44 hrs.	% Inc.	Pac. Coast % inc. over Montreal
Shipwrights	$16.50	$27.80	68.5	$34.45	108	$36.30	120	30
Joiners	16.50	26.50	60.0	35.77	116	36.30	120	37
Patternmakers	16.50	31.80	92.0	37.00	124	39.30	138	24
Plumbers	16.50	27.80	68.5	34.45	108	33.00	100	19
Blacksmiths	16.05	27.80	73.0	34.45	114	33.00	105	19
Hammermen	13.00	17.50	34.5	35.15	93	24.64	89	41
Painters	16.05	23.85	48.5	29.15	82	20.22	88	26
Machinists	14.40	29.25	100.0	35.75	148	33.00	129	12
Rivetters	15.55	29.15	87.0	35.75	130	33.00	100	12
Holders on	14.15	26.25	85.0	26.50	87	25.52	80	*2¾
Platers	16.05	29.15	81.0	26.50	65	33.00	105	12
Caulkers	15.55	29.15	87.0	35.75	129	33.00	112	13
Electricians	16.50	27.80	68.0	35.77	116	33.00	100	18
Riggers	13.20	23.85	80.0	31.80	141	33.00	150	38
Laborers	12.70	20.00	57.5	21.20	67	21.12	66	5
Engineers	16.09	33.75	110.0	33.75	110	33.00	105	*2
Boiler makers	....	39.25	....	33.75	...	33.00	...	*19
Boiler makers, rivetters	16.50	39.25	137.0	33.75	.100	33.00	100	*19
Boiler makers, helpers	12.40	20.00	61.0	22.50	80	23.65	91	18

*Dec.

Approximate Increase—
Montreal over England 80%

Port Arthur over England 108%
Pacific Coast over England *110%
Pacific Coast over Montreal *15%

*Not allowing for lower number of working hours.

Needless to say, if private capital is to be invested in the purchase of ships, they will buy in the cheapest market, and cost of building being about the same here and in the United States, the competitor of both countries will be Great Britain. If the industry is to expand, or even continue to the same extent as before the war, it is apparent that it can do so under one of two conditions: wages must come down in the steel making and shipbuilding trades, or the industry must be helped by some system of bonuses or tariff protection.

Before the war a common objection to the feasibility of building ships here was that we did not have a supply of skilled labor. That objection has, to a large extent, vanished. A large body of skilled labor has been trained here during the war. As a matter of fact there is nothing very intricate or technical about the majority of the operations in building a ship, and the time required for men to become reasonably skilled is not long.

The immediate policy of the government in regard to the industry will be to fill up the present berths as they become empty, and, so far as can now be seen, this will continue for an indefinite time to come.

NOVEL ENGLISH SPEED REDUCTION GEARS

By F. C. P.

The English speed reduction gears shown in the accompanying illustrations were designed at Willesden, London, England. These reduction gears are constructed on the epicyclic principle, having sun and planet pinions running in oil and enclosed in a cast-iron dust-proof case. The pinions are cut from solid steel blanks by special machinery and bushed with phosphor bronze, and the pins on which they turn are all carefully case-hardened.

There are oil grooves cut, along which when the gear is running the oil is forced into various bearings by centrifugal force. For large power gears running at high speeds an oil cooler is attached and the pinions are frequently cut from special high quality nickle steel.

Owing to the efficient system of lubrication, and to the special shaping of the wheel teeth, a very high efficiency is obtained with this gear, 90 per cent to 95 per cent being obtained, and this efficiency unlike that of most other forms of gear, is found to be lasting. Instead of the load being transmitted through one point of contact, as in most gears, it is divided between three points simultaneously, thus greatly reducing the pressure between individual teeth, and consequently the friction and wear.

It will be seen that by varying the size of the pinions, it is easy to construct a gear to give any required reduction, there having been developed gears of from 3 to 1. 2.000 to 1 reduction. The slow shaft at one side of the gear is in a straight line with the fast shaft entering on the other side. It is often a very great convenience to have the drive in a straight line with the engine or motor shaft as in these gears. A friction clutch is provided in the gear which allows the engine or motor to be started without any load on, and when started, the load may be gradually applied by means of the clutch.

It may be stated with regard to the life of the gears that there have been several cases in which they have been running for 7 or 8 years and a number running in the Willesden Works for driving line shafting and machines from electric motors for 8 or 9 years, the original wheels being still in use.

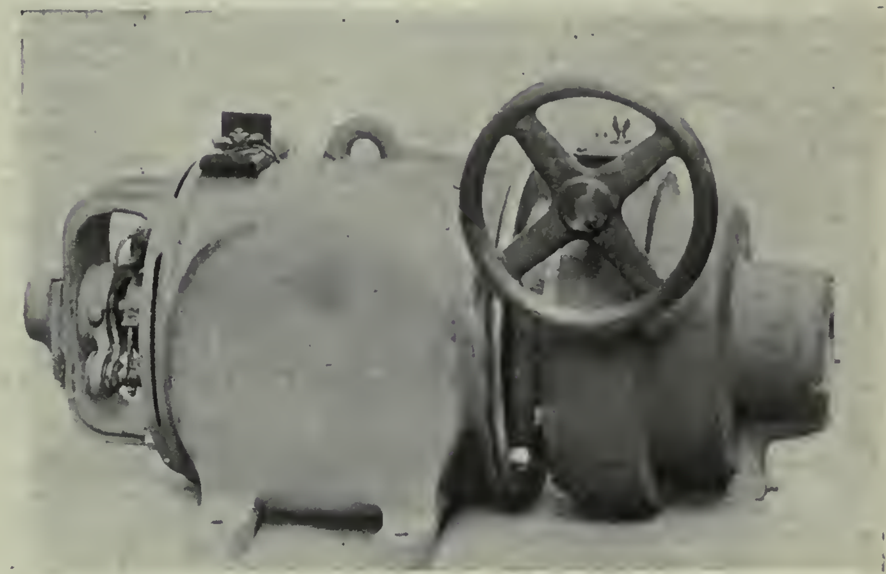
The advantage of the direct electrical method of driving machines in almost all kinds of manufactories is now very generally admitted, it permits the machines to be placed in any position and does not restrict them to the line of the shafting; they can be placed in out of the way positions far away from the source of motive power; the very heavy losses due to belt slip and friction on line shafting and counter shafting are avoided. Finally and perhaps more important than all others is the advantage that where each machine has its own motor no power is being wasted during the time that the machines or some of them are standing idle.

It is claimed that one difficulty which has stood in the way of the application of the electrical drive has been the high speeds at which electric motors of low and medium powers run, and the inefficiency of the ordinary means employed to reduce these speeds to those of the driven machines. In many cases where the driven machines run at low speeds as much energy is absorbed by the gearing or belt transmission as would suffice to drive the machine. Counter shafting with the necessary belting takes a great deal of room and is constantly requiring attention and even then the loss of power due to friction and belt slip is very considerable. Worm gearing if carefully constructed for low radius of reduction is fairly efficient while new, but wears very quickly, and is then, and when employed for high ratios of reduction, notoriously wasteful in power. Slow speed motors can be obtained, but are necessarily very heavy and very costly.

Another difficulty which applies especially to places where alternating current is used is the difficulty of starting up the motors under load. These difficulties are entirely overcome by employing speed gears for coupling the electric motor to the driven machine.

This gear is an adaptation of the epicycle principle, spur wheels and pinions being used throughout arranged to distribute the driving force in the gear as to reduce the pressure between the teeth of the gear wheels as much as possible, thus ensuring high efficiency and reduced wear. This is accomplished by always having a large number of teeth of the wheels in mesh and dividing the load between certain number of points in the gear, two in the low ratio gear and three in the higher.

It will be seen that the sun and planet wheels run in oil, and are carried in a cage upon which centripetal grooves are cut, which distribute oil under pressure to all bearings, and the gearing, being cased in, is thoroughly protected from dust and dirt. The teeth of the wheels are very accurately cut by special machinery from steel blanks, and the wheels are suitably bushed. In special cases nickel steel pinions are used.



ENGLISH SPEED REDUCTION GEAR ATTACHED TO MOTOR

This gear is noiseless and very compact. It is usually fitted on an extended bedplate with the motor. These gears with any ratio up to 30 to 1 can be used to increase speed instead of reducing by working from the opposite end of the gear. In this form they can be successfully employed to couple slow-running engines to dynamos. Most reductions required for any commercial purpose can be obtained in a very small space.

There are a great many of these gears in use for mining haulage work, stamps, elevators, pumps, line shafting, conveyor bands, mixing machines, gas blowers, and for numerous other purposes where the speed of the driven machine is comparatively low.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

CENTERING TOOL FOR DRILLING CONCENTRIC HOLES

By D. A. Hampson

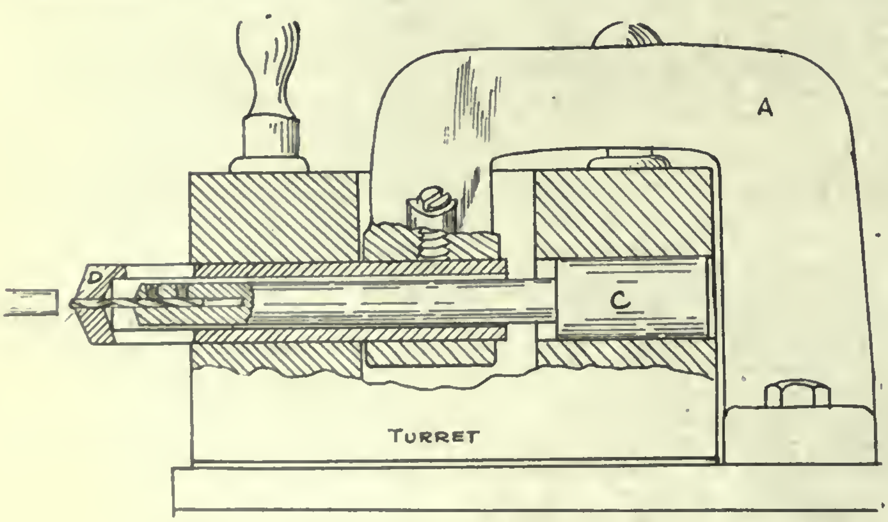
ANYONE who has done automatic screw machine work knows of the necessity for centering if a concentric hole is to be produced. At times a set-up may be so involved that there is no chance to use a centering tool in any of the turret holes; then various devices are resorted to which put in the center by a combination of turret and cross slide movements actuating an auxiliary tool; again, no center at all will do if the drill is large and has but a short extension beyond the holder. But if there is no way to get in a center and the drill is small and must enter the work a considerable depth, then a breakage of a dozen drills an hour must be expected and a large number of eccentrically drilled pieces will result.

If not pushed and with a machine in first-class condition, an operator can keep the severed end of the bar flat; against this flat end a small drill will usually start true if a light feed is used. but given average conditions and we find a suspicion of a raise or teat on the bar end which works havoc with the drills.

We had a ½-inch hand screw machine that had been rigged up to work automatically, that used but one of five holes in the turret and as a consequence was not made to revolve the latter. The machine did well on plain work. Unexpectedly, it was necessary to put the machine on a steel piece that had a 1-16-inch hole ¼-inch deep, and it was impossible to arrange any centering tool. The device shown by the drawing is how the work was done successfully with but little drill breakage.

A yoke shaped piece A was fastened to the turret saddle reaching over inside the turret and holding the guide D, sliding in the forward hole and having a hardened end to guide the drill. The guide D is drilled out almost its entire length and in this space there extends the drill holder C, carrying the drill at its forward end and secured to the turret at the rear end. Slots in the free end of D give access to the screws holding the drill and permitting chips to fall out below.

The guide is set an eighth of an inch away from the work; it remains in one position all the time but the drill passes in and out according to the camming of the machine. The hole at the rear of the turret secures and moves the drill instead of the front hole as usually done. Operation was quite satisfactory, the drill in effect being guided as in a drilling jig.



SET UP FOR DRILLING CONCENTRIC HOLES

STRAIGHTENING HARDENED PIECES BY VARIOUS METHODS

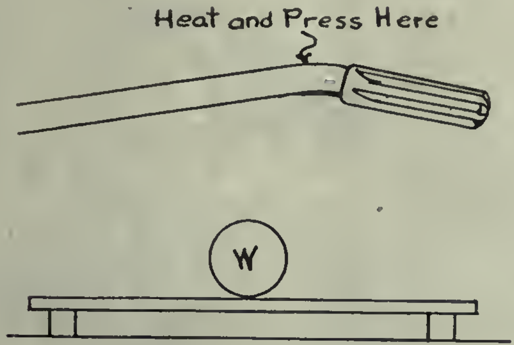
By D. A. Middleton

All machinists know in a general way that tool steel pieces that have been hardened can be straightened. But in trying out the method—heating the part and springing it in the direction it should go—there have usually been disastrous results. I have seen 1-inch arbors that had got bent put in the lathe and forced over by a piece in the tool post and about the time they assumed the desired shape, they snapped like so much glass. Breakages will occur—do occur even in plants that make drills and reamers and have experienced straighteners at work all the time—but if the principles are understood and care exercised there is no reason why much crooked work cannot be straightened and represent a big saving for the shop.

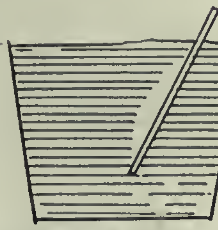
It must be understood that freak bends belong in another class. A piece 8 inches long with an inch of bend cannot be straightened—here the trouble is ignorance or carelessness on the part of the hardener or it has originated from lack of knowledge as to working the steel in the machine shop. But supposing a special rose reamer for a ¼-inch hole has been carefully made up and tempered and when put on the centers it shows a bend of a sixty-fourth—that can be straightened very easily.

Heating

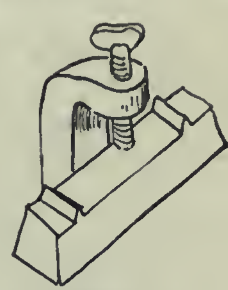
The heating is done in a variety of ways according to the shop equipment and the nature of the crooked piece. A "hot plate" is often the medium for flat pieces, a Bunsen burner or ordinary gas flame or an alcohol torch serves very nicely in other cases, and even the forge fire can be made to answer when the piece is large. One would naturally think that as the hollow, or concave, side of the crooked piece has to stretch out in straightening that that side would be heated to take advantage of the expansion that occurs with a rise of temperature, but such is not the case—the heat is always applied to the "high" or convex side.



EFFECTS OF HEAT AND PRESSURE.



EFFECT OF PLUNGING PIECE IN WATER ON A SLANT



SMALL PRESS FOR STRAIGHTENING

Gauging the Heat

If the part being straightened has been polished, the workman can tell when the limit of heating has been reached by the appearance of the lightest straw color; in most cases this will be the limit, though in others the natural working state of the part may correspond to a blue and in such cases any color up to the blue will do no harm. A good way to gauge the heat is to put a film of oil on the concave side, then when this begins to smoke, it is a sign that the temperature has risen several hundred degrees and the work is ready to spring. Various oils have different flash points, so if desirabble they can be roughly calibrated and used according to the different tempers in different work pieces. A point in favor of the oil method appears when the work cannot conveniently be polished or when the flame is of a discoloring nature.

Making the Bend

Having brought the work up to right heat, the greatest heat at greatest bend, it is transferred quickly to some sort of a straightener or to lathe centers. With a portable source of heat, the heating is done with the work already in place. Selecting the point of greatest bend, pressure is applied on the high side, springing the work until it bends the other way. By holding the piece so, as it cools, a permanent set is acquired. It is possible to overdo the spring and bend the piece in the opposite direction—experience, good judgment, and trial will tell how far to carry this; skilled men seldom have to re-heat a piece.

Pieces with centers in may be handled in a lathe. In lieu of this, the small bench straighteners on the market are supplied with centers and these are the most convenient means of straightening rectangular shaped pieces. Slender pieces may be held by pliers in each hand. Another way is to weight the part that has been heated. A shop that had quite a variety of this work to do—largely flat and square-made cast iron straighteners, very simple and cheap, and as the work was all delicate, a ⅜-inch thumb screw furnished all the "power" necessary and was a safeguard against too much springing. The lathe and the straightener have been disastrous in so many cases because "a man gets too strong" when using them.

Prevention has always been better than cure; applied to hardening, much of the warping and crookedness can be avoided by proper heating and dipping. It is generally known that long pieces should be dipped straight down—sometimes they are suspended from a string to insure this. When a piece is held at angle and plunged, it cuts a path through the water which cannot close quickly enough to give the same intimate contact on the back as on the leading side, with a result that the leading side cools first and contracts, giving it a concave form which necessitates straightening. In some kinds of work this may be taken advantage of and forms a trick of the trade—as in file hardening where the back of a half round has more surface than the flat side and consequently contracts more if dipped straight, but the hardener overcomes this by dipping the file at an angle.

SLIPPING OF BELTS

By M. E.

Belts, when running slowly and transmitting little power, may run a considerable time without giving evidence of slip, but when running at recognized speeds for the transmission of power, the slip may be considerable, although it is hardly a subject for calculation. Many factors may enter into the causes of slipping, slackness being the most important. Slipping, once begun, may polish the inner side of the belt and reduce its adhesion. A layer of air is said to enter between a high-speed belt and its pulley, serving as a lubricant and reducing adhesion. As a remedy, perforating the pulley with holes has been tried, but without definite results. Centrifugal action has also been suggested as a cause for slipping; but, when reduced to calculation, the centrifugal of a piece of belt x weight running at w speed round a pulley by radius would be a very small amount compared with the united pull of the driving and returning sides of the belt. There is another consideration, usually neglected, that may account for what might be called the permanent slip of all belts that are to any degree elastic. The driving and return sides of a belt work under different stresses, and as it passes from driving tension to return tension it is altering in length to the measure of its elasticity. When entering on the driven pulley it travels partly round before meeting the pull of the driving side, which takes place before it reaches the point of release. It is here that the belt is stretched and the permanent slip or creep takes place, which, in every elastic belt, is unavoidable. A properly adjusted steel belt should be free from this peculiarity and should ensure an accurate transmission of speed in all machines except those in which the respective revolutions of axis bring about fixed recurrent relations as in clockwork. Irregularities of belt transmission arise from dirt adhering to the pulleys or to the belts, and also from the action of heat and moisture. All belts and cords contain some moisture, and any increase or decrease of this moisture affects their length. A leather belt shortens on drying and elongates on becoming wet. Hair has the same property as leather, and this property is utilized in the hair hygrometer for measuring atmospheric humidity. Cotton cords and belts, on the contrary, shrink when moistened and elongate when dry. This is due to the alteration of the thickness of the fibre which, when twisted either in woven tissue or cord, swells and alters the angle of twist, causing contraction. Air may hold a great deal of moisture in suspension but, if hot enough, it can absorb more, and thus an oppresively hot and moist atmosphere is still capable of drying and slackening driving ropes and bands.

THE MINIMETER FOR FINE MEASURING

By FANK C. PERKINS.

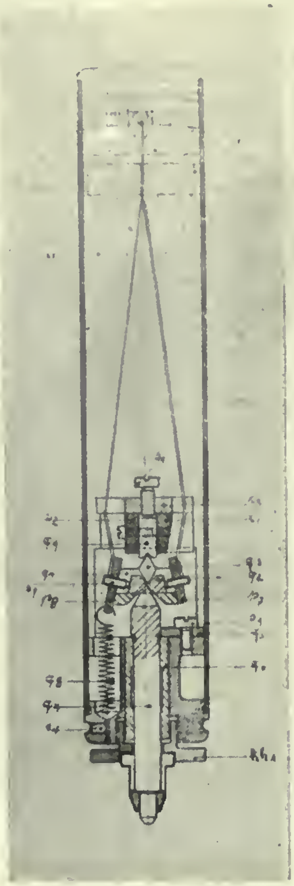
THE accompanying illustration shows the various forms of minimeter of the Hirth design for measuring threads, balls, cylindrical parts and grooves, also for inside measuring of various diameters. It is claimed that there has been a revolution in fine measuring since the war as the greatest care and precision has been necessary in the manufacture of guns and shells.

The development and progressive specialization of modern machinery and the wholesale manufacture of same, necessitates the interchangeability of parts, thus demanding the most perfect measuring instruments. The ordinary rule, caliper gauge with vernier, the feeler, and the deoth gauge, are only sufficient for approximate measurements. Micrometer screws serve for fine measurements and are adjusted on valuable and sensitive measuring instruments.

The construction of the micrometer is well known. It allows gauging to within .0005 of an inch, but its use requires the practiced hand of a skilled workman and, in spite of various improvements, two persons seldom obtain the same result in measuring the same part. The wear of the anvils, the spring of the shoe and the play of the screw, which needs lubrication, are the causes of many errors in taking measurements. The measuring limits of a micrometer are also small, as long screws cannot be made sufficiently accurate.

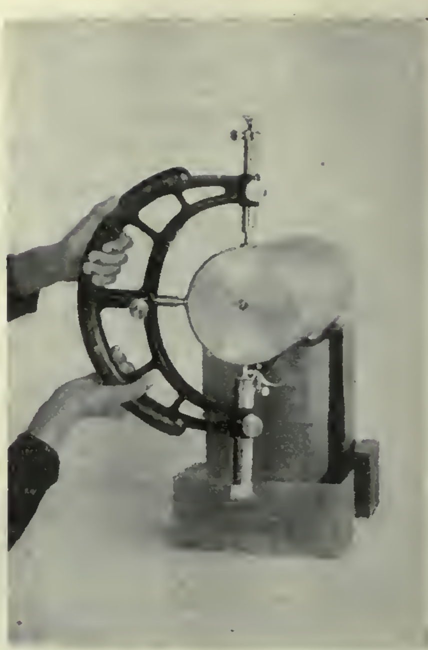
For absolutely accurate measurements only measuring machines can be taken into consideration. The German machines made by Reinecker and various American machines vary considerably in their methods of exact adjustment, but are in principle more or less large micrometer gauges. In both type of machines the measuring disc is divided into thousandths round its periphery, but .000005 of an inch can be read on the vernier. This fine graduation, however, is only useful when the screw is employed in short lengths, that the error arising from same may be neglected. It is therefore necessary to adjust by means of limit end gauges by steps of one inch or, when most accurate measurements are required, in stages of not more than .25 of an inch.

MINIMETER WITH STAND FOR MEASURING THREADS UP TO 80-MM.



SECTION THROUGH MINIMETER

It is true that the instalment of a fine measuring machine and the sets of end gauges which accompany it involves heavy cost, and its use requires much experience. Such a machine is therefore practically limited to the works testing room and may only be used to adjust the limit gauges. The latter are really the actual measuring gauges used in manufacturing and it is a well known but deplorable fact, that they very soon lose their accuracy through wear. Their maintenance is accompanied by large and continual expense, but their greatest drawback is that they are useless except in practiced and skilful hands and only register if a dimension is too large or too small, leaving the amount of error unknown, thus giving the limits of error an unsafe and unsatisfactory character.



MINIMETER WITH HOLDER FOR CALIPERING CYLINDRICAL PARTS

The completion of the work can therefore only be carried through with great care and considerable loss of time by constant measuring and checking.

The fine measuring instrument known as the Minimeter illustrated, it is said, avoids all the drawbacks by its original and simple construction and enables this class of work to be revolutionized. The principle of the Hirth Minimeter consists of a lever having unequal arms carried on knife edges. The use of a double system of levers and bearing pins being discarded, oil films and all play are entirely avoided, thus doing away with the causes affecting precision of apparatus. A longer or shorter distance between the points of support of the lever allows a variation of travel of the indicating hand, whilst the length of the latter remains the same, thus permitting of any given ratio of lever arms to be used.

There is a spring which holds the lever on to the knife edges and keeps it in its normal position when out of use. The whole appartus is screwed into a tube with a glass covered opening at its upper end, showing the graduated dial, bearing the proportion of the lever arms (1:100, 1:200, 1:500, 1:1000), and above which the hand of the lever moves. All the working parts are made glass hard.

The photographs show a complete instrument in actual service. The clamp holding the minimeter slides up and down, thus allowing the minimeter to be set very quickly by means of the screw behind the head of the minimeter, and is locked by the two clamping screws at the side. The adjustment is made by means of two standard gauges. The two rests supporting the part to be measured, consist of two hardened and ground cylindrical rods, so that any wear on the rests does not interfere with the accuracy. The clip holding the rear rest can be adjusted for various diameters of work according to the scale, which can be seen in the illustration. The scale has proved itself a great time saver in adjusting and measuring various sizes of work. The end of the measuring pin is made semispherical, but can also be made conical, if required. The lever at the lower end of the minimeter enables a light finger pressure to raise the measuring pin and thus allows free introduction of the part to be measured, avoiding premature wear on the rests and permitting the measurements to be taken rapidly.

In the minimeter for measuring larger dimensions, the construction of the lower end of the shoe allows a fine adjustment of the instrument, by means of a fine threaded screw, which is locked by two milled nuts. The shoe is held in a wooden socket which closes on hinges.

It is pointed out that by the arrangement for surface measurements, they can be readily taken and the platform or table can be quickly moved within certain limits, by means of the screw underneath. The minimeter holder is in the form of a double clamp and allows horizontal or vertical adjustment over a large field.

Besides the minimeters above mentioned, arranged for outside measurements, the difficult matter of inside measurements has been considered and an absolutely exact, useful and rapidly operated instrument has been made. Until recently one has had to be satisfied with plug gauges and micrometers, which give doubtful results with small bores. An important step in this direction has also been made in the minimeter for this purpose, which is a well-thought-out arrangement for inside measuring of small parts.

The diameter of a circle being given by three points of contact, two fixed ball points are arranged on the cylindrical measuring head, whilst the third point is attached to a lever, borne on knife edges. This lever is in contact with the arm inside the casing and causes a proportional deflection of the indicating arm in the manner previously described, if this arm is pressed. The horizontal contact pins serve as side stops for the measurement of rings. This apparatus can be used for measuring various diameters, by changing the measuring head.

In the special arrangement for measuring inside rings, the minimeter is fastened in the upper sleeve and the three surfaced stops, which are let in, form a rest exactly at right angles to the axis of the ring. The two slots allow for a wide range of varying diameters. It may be stated that inside measuring instruments in various sizes up to 40 inches diameter are available by means of interchangeable rods.

MINIMETER WITH TUBE FOR INSIDE MEASUREMENTS BETWEEN 175-150-MM. AND OF LARGE DEPTHS

PRINCIPLE OF MINIMETER

THIN VERSUS THICK BELTS

By Mark Meredith

In a recent conversation with a man whose experience entitles him to respect the subject of belt life and endurance was broached. The individual in question has pretty definite convictions on the subject, and explained that he would not give double belting house room. He explained that unless the pulleys were of inordinate size the internal stresses in the belt by flexure and repeated bending wore them out in a very speedy manner. His solution is increase in pulley width and decrease in thickness; indeed, he goes further and says that even where pulley width cannot be increased it is quite as economical to use a thin belt, it will last as long. Interpolating as to belting of the Hendry type where the thickness can be anything desired, I was informed that this type of belting was ideal, but it was best not too thick.

As practical instances of what could be done at a pinch in an emergency, a neighboring factory shut down by the main drive belt repeatedly breaking, was got going again by teh use of stout roller toweling purchased at the local drapers. I was invited to see the belting in use in the particular shop, and also that in the stores; it was certainly all single, and even so, thinner than ordinary. The pulleys driving various tools and machines were all criticised on the ground that speed cones were invariably too narrow, that is from my friend's point of view.

Although much has been written first and last on the subject of belting, the particular point elicited here does not seem to have been made permanent. Leather can be had single and double, and there are processes of tanning which plump out the substance to obtain the greatest weight from the original hide. Indeed, for years past the proverb, 'there is nothing like leather," needed revision, for steady deterioration has been a universal experience. In judging, therefore, between rival offers accompanied by small samples, it needs caution, for the best color and substance is by no means the best article. The belt running over small pulleys, as in a high-speed sensitive drill, which stretches like elastic and grows thinner and thinner at each take up, is by no means uncommon, and perhaps the conditions in this instance are the worst possible. It is equally certain that a thick belt on a small pulley has no more adhesion than the thinner type, and slippage means speedy destruction. If for unavoidable reasons the width of the pulley must be limited, and the belt thickness increased to stand the load, the pulleys must be as large as possible.

The same facts apply to balata. This can be obtained 3, 5, 7, and 9-ply, the latter unusual, but provided that the belt is narrow there is no reason why the thickness need stop here. The limiting factor is the width canvas can be woven. My informant, whose opinions are entitled to respect, believes in thin belts of adequate width. He has given much attention to the subject first and last, and the unsuspecting belt salesman who calls for the first time is apt to be crestfallen at the result of the interview. My reason for relating the foregoing is that, from personal experience I am inclined to think that many machine tools have stepped pulleys too narrow on the steps. Where conditions are good it is really wonderful the length of time that a piece of first-rate belting will endure; it reaches a dozen years in some instances, a length of time which may cause surprise in those quarters where belting costs are a disproportionate annual expense.

STANDARD SPECIFICATIONS FOR BABBITT METALS

THE American Society for Testing Materials, at its annual meeting at Atlantic City, N.J., June 25-28, 1918, proposed the following specifications for babbitt-bearing metals, designated as grades Nos. 1 to 12:

TABLE NO. 1—FORMULAS.

	Copper Per Cent.	Tin Per Cent.	Antimony Per Cent.	Lead Per Cent.
No. 1	4.5	91.0	4.5	....
No. 2	3.5	89.0	7.5	....
No. 3	8.33 1/3	83.33 1/3	8.33 1/3	....
No. 4	3.0	75.0	12.0	10.0
No. 5	2.0	65.0	15.0	18.0
No. 6	1.5	20.0	15.0	63.5
No. 7	...	10.0	15.0	75.0
No. 8	...	5.0	15.0	80.0
No. 9	...	5.0	10.0	85.0
No. 10	...	2.0	15.0	83.0
No. 11	...	....	15.0	85.0
No. 12	...	....	10.0	90.0

TABLE NO. 2—PHYSICAL PROPERTIES OF METALS.

	Deformation of Cylinder 1¼" diameter, 2½" high at 70° Fah. in.			Melting Point. Degrees.	
	At 1,000 lbs.	At 5,000 lbs.	At 10,000 lbs	Fah.	Cent.
No. 1	0.0000	0.0010	0.0150	453.2	234
No. 2	0.0000	0.0015	0.0120	460.4	238
No. 3	0.0010	0.0045	0.0070	462.2	239
No. 4	0.0005	0.0025	0.0090	365.0	185
No. 5	0.0010	0.0030	0.0090	.....	...
No. 6	0.0015	0.0050	0.0180	.....	...
No. 7	0.0010	0.0050	0.0230	464.0	240
No. 8	0.0020	0.0090	0.0630	469.4	243
No. 9	0.0040	0.0120	0.0840	469.4	243
No. 10	0.0010	0.0100	0.1540	471.2	244
No. 11	0.0010	0.0100	0.1190	474.8	246
No. 12	0.0025	0.0170	0.2850	474.8	246

The society wisely refrained from recommending these formulas for any special purposes; confining themselves to the statement that "these specifications cover the range of alloys commercially used."

It is regretable that these tables do not also give the coefficients of friction as this information would have been perhaps the most useful aid in determining the relative values of these twelve bearing metals—especially if tests had been made with water lubrication. But the society has made a good start and doubtless they will give these frictional coefficients at some future time.

However, the data furnished in these tables is useful for purposes of comparison, and the object of this article is merely to point out certain facts in connection with these figures that may have escaped general notice.

Many users of babbitts, especially those required for heavy duty, are very careful to specify "copper-hardened" metals, and certain manufacturers of babbitts, knowing this pedilection, boost copper-hardened products. In this connection we call attention to formulas Nos. 3 and 8, given in above tables.

No. 3 is a tin base metal and contains 8 1-3 per cent. copper, the highest percentage of copper in any of these formulas. This composition, under 1,000 lbs. pressure per square inch, compressed to only 0.0010, or one one-hundredth of an inch, and its melting point is 462.2° Fahr.

No. 8 is a lead base metal, which contains no copper, under pressure of 1,000 lbs. per square inch, compressed to only 0.0020, or two one-hundredths of an inch, and its melting point is 469° Fahr.

The difference between these two alloys under 1,000 lbs. pressure per square inch is only one one-hundredth of an inch, which is in width about equal to a line made by the stroke of a hard lead pencil, and the same relative difference between these two metals is maintained at 5,000 lbs. pressure per square inch.

As to the melting point of these two alloys, the lead base metal has the better of it by about 7° Fahr.

When you consider that the tests shown in Table No. 2 were made by compressing a small cylindrical-shaped block, and that in actual use a babbitt metal would, in most cases, be supported by a backing and further bolstered by recesses, the difference in sustaining powers between a tin base copper hardened metal and a lead base metal is practically nil.

Table No. 2 also gives a good illustration of the influence of lead in tin alloys, as shown by No. 4. This composition contains but 10 per cent. lead, yet this small quantity was enough to reduce the melting point to 365° Fahr., which is about 5° lower than the fusibility of half and half solder.

Attention is also called to the fact that the compressive strength of Nos. 10 and 11, which contain neither tin nor copper, is equal to that of No. 3 at 1,000 lbs. pressure per square inch, but at the higher pressure the No. 3 shows greater sustaining strength, due doubtless to its greater malleability, but such high pressures are rarely, if ever, used in actual practice. It is rather anomalous that alloys Nos. 1 and 2, which contain less copper and antimony than No. 3, should show greater resistance to pressure.

The conclusion that can be drawn from the foregoing figures is very favorable to the use of lead base alloys for all bearing purposes except in cases where malleability is a prime requisite and paramount to all other considerations on certain forms of thin, loose shell bearings.

The lead base metal is unquestionably superior anti-frictionally to the tin base metals and by reason of that quality it wears longer, runs cooler and protects the bearing from the injurious effect of frictional heat, and it is very much cheaper.

The lead base metal also has an advantage in pouring as the tin base metal with high copper content has to be brought to a much higher heat to obtain the proper fluidity to obtain a good casting.

These figures of tests are doubtless dependable, and assuming that they are at least approximately correct, they unquestionably show the fallacy of using the copper-hardened tin base metals merely to obtain compressive strength and apparently authorities in these matters have been taking a good many things for granted.

The fact that lead base metals are being used successfully under extremely high pressures is evidence that their failure in some instances where the tin base metals succeed is doubtless oftentimes due to improper handling rather than fault of the metal.

THE DEVELOPMENT OF NITROGEN FIXATION IN AMERICA

In a lecture on the nitrogen problem, by Professor A. A. Noyes, at Washington recently, the author said that as regards "fixation" processes, America is now working, to a greater or less extent, all the methods which have been developed during the past fifteen years. Even before the war the American Cyanamide Company at Niagara Falls was producing about 20,000 tons of cyanamide a year, largely for use in agriculture. By the action of steam upon this substance it is practicable to get substantially all the original nitrogen in the form of ammonia. This process is capable of a great extension, and has already reached considerable proportions in Germany, where it competes with the Haber process. The American government is building a cyanamide plane with a capacity of 110,000 tons of ammonium nitrate at Muscle Shoals, Alabama, and a third plant has been authorized for the production of another 110,000 tons in Ohio. The cyanamide process has the advantage that it can be installed in many places in the country, and that it requires little power. It has probably a great future before it—certainly immediately—but whether it is ultimately destined to be supplanted by the synthetic process time alone can show.

WELDING AND CUTTING

IMPROVED LEVIN OXY-HYDROGEN GENERATOR

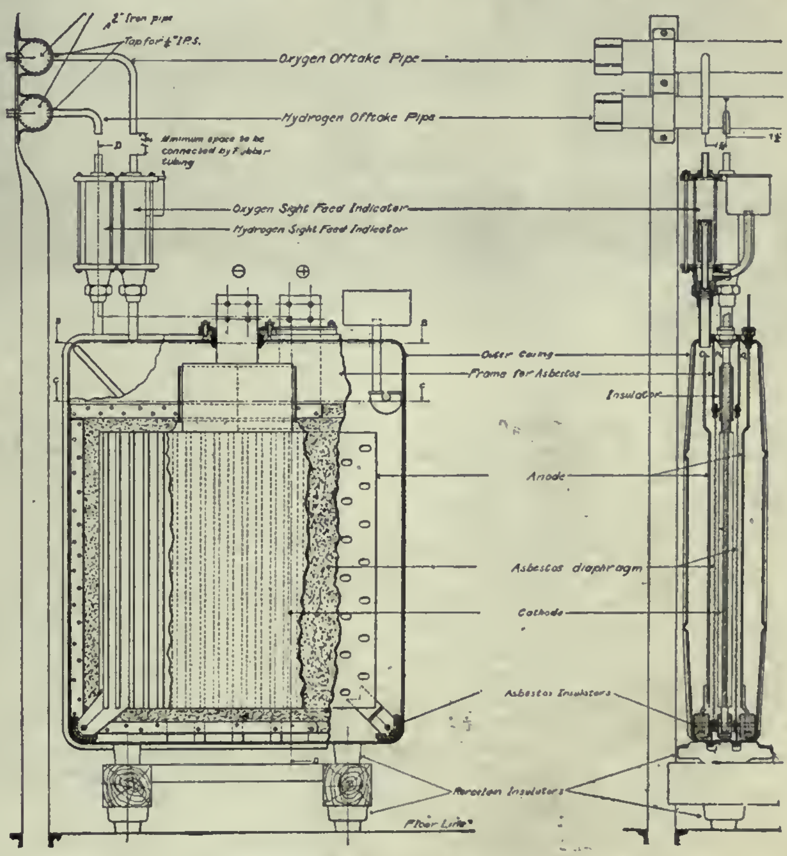
THE demand for oxygen in connection with the oxyacetylene process having increased in enormous proportions, several firms have contemplated installing their own oxygen plants in order to decrease their outlay for gas and at the same time assure themselves of a constant supply, thus avoiding delays due to effective transportation and the cost of the same. In view of these conditions the following may be of interest. The accompanying half-tone and line cut illustrates the Levin type of generator for the decomposition of water by means of electrochemical action, for the production of oxygen and hydrogen for commercial and chemical purposes. These generators are designed on the unit principle, being small and compact, simple in construction, and

EXTERIOR VIEW OF CELL

built of a few standardized parts which insures rapid and accurate assembly. Each generator consists of three compartments, the oxygen being generated in the two outer chambers and the hydrogen in the inner or centre compartment. The division walls are comprised of two sheet metal frames supporting asbestos diaphragms. The electrodes are independent of the casing, being separated from it, but fixed in position by means of the specially designed blocks of asbestos, for efficient insulation. A distinct feature of the generator is the use of Cobalt on the electrodes. Water is fed to each compartment independently, the inlets also providing a suitable blowoff or vent from each section, when the generator is operating under abnormal conditions.

A specially designed sight-feed indicator is located in the discharge pipe, between the generator and the main offtake pipe. This method makes each unit independent of all others in the group. The individual indicators not only serve to maintain uniform pressure in the different compartments of each unit, but enable the operator to see at a glance the action of the generating process and the quantity of the gas being formed. Another important feature of the generators is the total absence of packed joints, a very essential factor in the maintenance in this class of equipment. Each unit is completely assembled at the plant of "Electrolabs," and the casing entirely sealed by means of welding. This is made practically by eliminating all material or component parts that would have a tendency to deteriorate through the action of the electrolyte, the formation of the gases, or the electrochemical action of the decomposing process. No elaborate installation work is required, as each unit is ready for operation immediately it is delivered, the only necessary detail being the placing of the short rubber connection to the main pipe lines and the filling with electrolyte.

The general dimensions of these generators are 30 inches in height, 25 inches in depth, and a width of about 6¼ inches. With the floor supports and porcelain insulators in position and also the upper pipe connections, the total height is not more than 4 feet 8 inches, thus insuring easy access and view to every portion. The unit system provides for the installation of sufficient equipment to meet the specific needs of the user, and the generators can be so arranged as to occupy the minimum amount of floor space, the replacement of a unit not requiring any more space than that occu-



ARRANGEMENT OF APPARATUS

pied by itself. The approximate production of one of these units, operating at 200 amperes, for 24 hours, will be 38.4 cu. ft. of oxygen and 76.8 cu. ft. of hydrogen, measured at 20 degrees C. and 760 m.m. pressure.

C. Royer, formerly general manager of the L'Air Liquide Society and acting manager of the Welding and Supplies Co., 1227 Ontario St., Montreal, is the Canadian representative of Electrolabs.

NEW WELDING PLANTS

The St. Lawrence Welding Co., Ltd., Montreal, have opened a new branch in Halifax, N.S., at the end of Evans Ltd., plant on the Dartmouth side. They are equipped to handle all classes of welding, oxy-acetylene, thermit and electric processes. This branch was opened about the middle of May and is now doing a large business in the welding line.

WELDING TUG OF THE ST. LAWRENCE WELDING CO.

The plant is equipped to take care of ship work and lead burning, and the firm is now fitting out a tug in the harbor that will be equipped with electric welding apparatus and an oxy-acetylene unit, also an air compressor of large capacity for operating the tools for necessary repair work. The tug will also have a large fire pump for fire fighting purposes. The branch will be managed by Mr. A. Young, an old employee of the St. Lawrence Co., who will work under the supervision of A. M. Barry, the managing-director. This company has branches in several of the large Canadian centres and anticipate the opening of additional ones as soon as the necessary organization can be trained.

Toronto.—We regret to announce the death from Spanish influenza of Capt. Anthony Randle. Capt. Randle came here in May last from England to take command of the ss. Asp, building at the Polson Iron Works. The deceased was only 31 years of age. His body will be shipped to England.

BOILER AND OTHER REPAIRS BY ELECTRIC WELDING*

WELDING is one of the oldest branches of the working of metals. In some respects it is a lost art, as there are good grounds to believe that the ancients were able to weld some of the bronze alloys. In the following remarks the author proposes to confine himself to the welding of iron and steel, unless otherwise stated. A weld is the intimate union of two pieces of metal, produced when the pieces have been raised to welding heat, by pressure or hammering, and the welding state of a metal only exists within a limited range of temperature, being something like 100° for iron and steel, but varies with the metal. As a rule, good iron will stand a higher temperature than steel, although certain steel, such as blistered or good shear will stand a high temperature. In the smith's fire steel can, and should be forged with a lighter tool than iron, the blows being in rapid succession. In the ideal weld the two surfaces to be united are brought to the plastic heat together, neither at too high or too low a temperature, when the point of juncture should be as strong relative to its section as any other portion. From the foregoing remarks, however, it will be appreciated that much depends upon the skill and experience of the operator, and it is recognised in ordinary engineering practice that an allowance has to be made for inevitable human frailties.

The first process of electric arc welding to be employed in a commercial sense was that of De Bernardos, which was used in Messrs. Lloyd and Lloyd's Works, over twenty years ago, in the welding of flanges and branches to iron and steel pipes. In the De Bernardos process a carbon is employed, an arc being drawn between the carbon and the job, a portion of which is brought to welding heat, and the added metal is heated in the flame of the arc. In the early Bernardos process the work was made the negative pole and the carbon the positive, but latterly the poles were reversed, thus doing away with the dangers of carbonisation of the metal caused by the natural flow of carbon particles from the positive of the negative. The Bernardos process is still largely employed in this country. Slavianoff substituted a metal electrode for the carbon electrode of the Bernados process, although Bernardos as far back as 1885 had the idea of using a hollow carbon filled with the adding metal. In the carbon electrode of the Bernardos does not seem to have anticipated, his difficulty being that, like many other great inventors, he was in advance of the means and appliances of his time. The names of many investigators and workers in our own and other countries during the eighties and nineties of last century could be honorably mentioned, each doing their little bit to advance what is practically a new trade. Among them Charles Lewis Coffin, of Detroit, U.S.A.; Mark Wesley Dewey, of New York, U.S.A.; Pommée, of Altona, near Hamburg; W. P. Thompson, of Liverpool; Thos. Odlum, of Virginia, U.S.A.; Francis Todd, of Newcastle-on-Tyne, and Joseph Fouilloud, of Paris.

We have already referred in the Bernardos process to the arrangement of the poles of the electric arc. Now it is generally agreed that the province of the engineer is to utilise the forces and methods of Nature for the benefit of mankind, and Nature in this case has provided that the positive pole of the electric arc shall be much better than the negative pole. We consequently arrange in electric arc welding that the positive pole shall be on the bigger mass, which in 999 cases out of 1,000 is the job, and the negative pole on the smaller mass of metal, which in modern electric arc welding is the metallic pencil of the adding material. By working with Nature we thus provide favorable conditions for the first essential of a good weld, namely, that the pieces to be united shall be brought to a welding heat at the same time. You will note that we have only provided favorable conditions; the actual carrying out of this requirement rests with the skill of the operator. This consideration of the difference in temperature of the two poles of the electric arc makes it at once apparent why direct current is more suitable than alternating for arc welding. On the other hand, alternating current is quite suitable, and probably better than direct current for what is known as resistance welding or for spot welding.

*Read before the members of the Institute of Marine Engineers, on March 12th, by Mr. R. S. Kennedy, Member of Council, I.M.E., M.I.C.E., Member N.E.G. Inst. of E. and S.

The author's Company* were the first to employ the metallic electrode in this country on a commercial scale—namely, early in 1910, although about a year previously Mr. Copeman, of the Furness Lines, had carried out a few experimetal jobs to his own vessels. Since 1910 the annual output of the British Arc Welding Company has increased at least 100 times, and during the present war its services have been utilised in directions which would not have been permitted under peace conditions. In making this statement, however, the author wishes to acknowledge assistance received from kindly and constructive criticism from the Board of Trade and Lloyd's Register in pre-war days,but everything has now been speeded up. In particular, the tests of electric-welded specimens carried out to the instructions of the Board of Trade in 1909 and 1910 were of great value.

These tests were made not only with the object of getting at the tensile strength of the weld, but of finding out if the process of welding affected the neighboring material. Numbers of specimens were tested, and some of these were annealed, but it was found that annealing made no difference to the results, and the material immediately adjacent to the weld behaved in a normal manner. These tests gave a tensile strength of about 17 to 18 tons per square inch, but since then improvements in the materials and methods have increased the tensile strength of weld in boiler steel to about 27 tons per square inch. In practice, however, the author would not recommend that a tensile strength of more than 20 tons per square inch be worked to, this giving a sufficient margin for possible small defects in workmanship. It might here be remarked that in no single case has the author known an electric weld to give way suddenly; failure has always been preceded by a small crack, which has gradually developed.

Electric arc welding is primarily a form of autogenous welding—that is to say, the metals to be united are heated to such a temperature that they will fuse together on contact without the application of external pressure. It is, however, found in practice that the application of even the moderate amount of pressure produced by a hand hammer increases the tensile strength and tenacity of the weld some 5 per cent. It is, however, essential that this work should be put into the material when it is at welding heat or, at any rate, above the black heat. It may here be remarked that it is often said that the value of metal added in this fashion is analogous to the ball of iron obtained in the puddling furnace. This, however, is not the case, and the better results are probably due to the fact that the iron wire used is of the very best material, with preferably a small percentage of manganese. This iron wire has been very heavily worked in the process of

*The British Arc Welding Co., Ltd.

FIG. 1—(TOP) BEFORE WELDING. FIG. 2—(BOTTOM) AFTER WELDING.

manufacture, and subsequently annealed, and as used by the author's firm shows a tensile strength of 28 tons with an elongation of 50 per cent. Somewhat similar results are obtained in another field with cast iron, which has several times been re-melted. The whole question of the amount of work put into the material of a weld is very fascinating, and there is no doubt that the capacity of a weld for taking up rapidly alternating strains for a long period, and for absorbing sudden shocks, very much depends upon this factor.

Returning to our blacksmith, whether under the spreading chestnut tree or in in the more prosaic conditions of the modern smithy, we find that they all employ some kind of flux, usually sand or borax. This flux surrounds the heated iron or steel and protects it against the impurities of the fuel, removing at the same time the coating of scales. Some impure wrought irons flux themselves, but with steel other mixtures are used. The flux, as its name indicates, also increases the fluidity of the heated metal.

In electric arc welding with a metallic electrode one great advantage is that, with the exception of the atmosphere, we have no impurities to guard except such as are introduced in the materials. The source of heat is pure, and we have to see that the job is properly cleaned and the metallic electrode of suitable material. Still, to provide against oxidisation and also to increase the fluidity of the metal a flux is necessary to good work in arc welding, and the heated metal is protected from oxidisation by an inert gas given off by the flux. The most convenient method of applying the flux is to coat evenly the metallic electrode, thus providing a constant and uniform supply.

Electric arc welding is a process of building up, and consists of adding metal to an existing structure. For this type of welding the electric arc has one great advantage in its high temperature. This is the highest known, and thus by the application of a small number of calories a part of the job, say, about ½ in. diameter, is almost instantaneously raised to welding heat, and the drop of adding metal from the pencil, also at welding heat is united to it, and the process of building up is continued till the required section is reached. The small quantity of heat required does not cause any undue expansion of the job in hand, and contraction troubles are reduced to a minimum. It is quite a common practice to weld over a riveted seam, although in this case it is necessary that rivets in the area dealt with should be completely welded over, and not left half covered. After welding a seam it is necessary to caulk the landing edge for some 6 ins. at each end of welded portion. Cracks in furnaces, end plates, combustion chambers, etc., are dealt with by cutting out the defective portion, leaving a V-shaped opening, which is filled in with the welding material. Work can be carried out directly overhead, or in any position that is accessible to the welding pencil, and where the operator can see what he is doing. As the work is one requiring constant attention on the part of the operator, it is advisable, in order to get the best job, to make it as accessible as possible, and that the operator should be reasonably comfortable.

In common with all hand welding, a good job depends on the conscientious work of the man. The author's firm have always trained their own welders, and keep them in constant employment. A full report is made of each job, and the name of the welder recorded, and the whole object of the training is to inculcate a sense of responsibility.

The materials at present dealt with on a commercial scale are wrought iron and steel and cast steel, and occasionally cast iron. The range of temperature of the welding heat is the determining factor in the adaptability of a substance for welding. Much successful work has been done with cast iron, notably with castings of considerable age, which have not been subjected to corrosive action, and with the good mixtures of more modern times. It is probable that there is a welding temperature of cast iron, but the range of this temperature is very small, something of the nature of 10°.

The voltage across the metallic arc is about 22 to 25, and the writer adds an equal steadying resistance which makes the voltage at the terminals of the dynamo about 45. A substantial resistance is employed which is put in circuit by an automatic switch, when the welder breaks his arc, thus keeping the load on the machine constant. The amperes actually employed are about 175, but in practice a 200-ampere machine is necessary, while the author's firm use machines designed for 250 amperes. In the big passenger liners it is the practice to weld from the ship's dynamo, suitable welding and substitutional resistance being provided. By a special winding of the dynamo, known as separate excitation, the machine can be steadied under varying loads, but even in this case the author still prefers to retain the substitutional resistances in addition.

The design of the portable machinery for generating electricity presents many interesting problems. Plant is designed to meet the varying conditions, and consists of wagons generating their own electricity, portable petrol driven generating sets, self-propelled or dumb barges with steam-driven or paraffin sets, steam turbine plants, and last, but not least, the motor generator sets

The preparation of a job for electric welding is a matter of considerable importance, as the presence of impurities is likely to be detrimental to the weld. In dealing with the external or fire surfaces of a boiler it is usually sufficient to use an ordinary chipping hammer, and then thoroughly wire-brush the metal to be dealt with; but some superintending engineers prefer to have a light chipping taken over the surface, which is, of course, the ideal preparation. In marine work, however, the time available is often so short that as a general rule the former method is adopted. When, however, it comes to dealing with the water surfaces of a boiler greater care is necessary, especially if zinc plates have been freely used. The welder, if a properly-trained man, would at once recognize this difficulty and apply the only remedy, which is to chip down till pure metal is reached.

Arc welding being a building up process, cracks are dealt with by veeing out at the line of fracture, the vee being made wide enough to ensure that the welder can reach with his pencil to the bottom on either side with a certainty of striking his arc at any required position. As the welder is a highly skilled man, it is usual for the boilermakers to prepare the work to instructions, and the welder himself puts in the finishing touches. The welding in of new backs to combustion chambers or tube plates, or work of that kind is dealt with in precisely similar manner, although here certain allowances have to be made for the work drawing together as the welder proceeds. It should be mentioned that in dealing with cracks it is absolutely essential that the whole of the fractured portion be cut away till a solid chipping is obtained, and then go a bit deeper to be on the safe side. If welding is carried out over a partially cut away fracture it is certain that sooner or later it will work to the surface. One of the most unsatisfactory matters we have to deal with is the welding of a crack in the original weld of a furnace, as it is most difficult to say where the defective weld ends, and a further defective portion some short distance along may work back into the part dealt with.

As in all engineering matters, it is better to know the worst and deal with it. The writer recalls an incident in our early days—about 1910—when we were called in to weld a crack, apparently about one inch long, in the back of a combustion chamber of a Swedish vessel. Our man started to cut out the crack when with a loud report the chamber back split right across, showing a fracture a full sixteenth open. This caused great alarm at first, and we were charged with using undue vigor, but on veeing out the fracture for welding it was found that the back was grooved right across on the water side, so we were exonerated. It is a merciful dispensation of Providence that such defects develop mainly when the boiler is cold or under banked fires, and it is generally recognized that a boiler is never safer than when warmed up and steaming steadily. Owing to its higher temperature the electric arc is more suitable for dealing with the heavier sections than the oxy-acetylene or oxy-coal gas, while, on the other hand, for thickness of 3-16 in. and under one or other of the gas systems is preferable.

The author has been asked to summarise as briefly as possible the conclusions reached in the very able papers recently read by Commander E. P. Jessop and Naval Constructor H. G. Knox, both of the U. S. navy. The principal welding consisted of the repairing of the cylinders of some eighteen German vessels, where large pieces had been broken from the upper portions. The method of repair consisted of the welding in by the electric arc or oxy-acetylene gas of a new piece in cast steel or cast iron to replace the portion broken away. In arc welding the old and useful device of tapping short steel studs into the cast iron was used to enable the added steel (in this case) to make a surer weld. The electric arc welding repairs were carried out with the cylinders in place, while with the oxy-acetylene process it was necessary to remove the cylinders so that the joints for welding could be laid in a horizontal position, and also that the cylinders could be heated. Commander Jessop quite truly points out that the great difficulty found in the arc welding of the cast iron surface was to get the first layer of the adding steel material to adhere, and that this layer was always added before the patch was put in position for welding. In the oxy-acetylene jobs, as before remarked, the cylinders were secured in place, and, the joints being horizontal, both sides of the joint were made fluid, and cast iron sticks melted into the bath thus formed. Both methods appear to have given excellent results, and the repairs are certainly the largest of their nature that have yet been carried out, and reflect the greatest credit on all concerned. It would not be wise, however, to generalise on the treatment of cast iron from these results. You will remember that we have before remarked that with good mixtures of cast iron one can with fair certainty make a good weld. It must be remembered that these were high class vessels, and that in all probability the very best metal would be used in their cylinders and liners, and certainly in superheater jobs the H.P. cylinders and liners would be of a very special mixture, which so far as the author's knowledge is concerned has only been made in this country during the last five or six years. He trusts that we may hear further on this point, but his present information is that these vessels were superheater jobs.

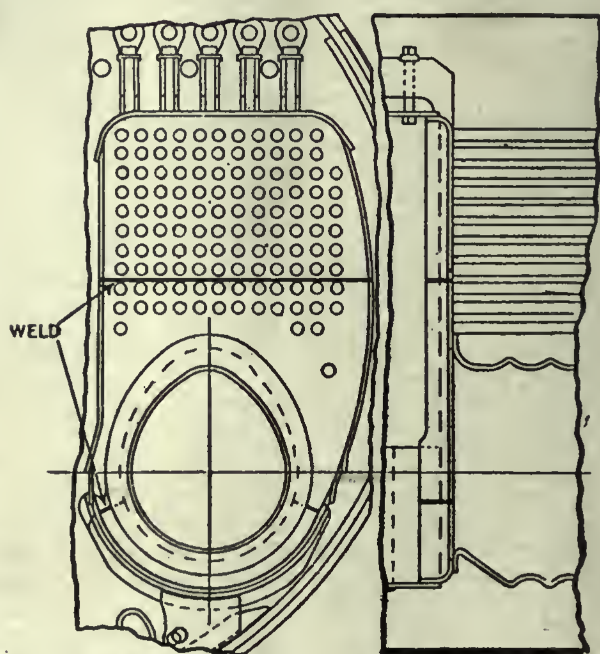


FIG. 3—NEW LOWER HALF TUBE PLATE WELDED IN.

The author claims that arc welding, where carried out by skilled operators with suitable materials, is absolutely re-

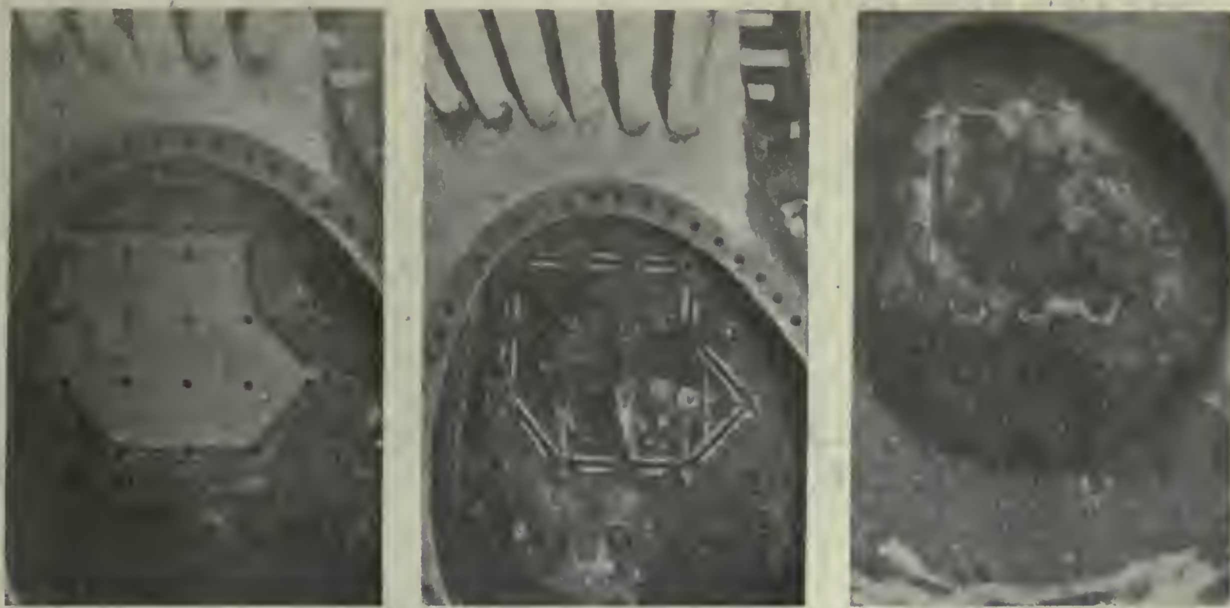


FIG. 4—MARINE BOILER COMBUSTION CHAMBER BACK

liable, and can point to some 20,000 jobs, some of a very big nature, while the percentage of even partial failures would, at any rate, be on the right side of the decimal point. These partial failures would be mainly accounted for where the work was carried out under unfavorable conditions, and often in the nature of a forlorn hope. Great difficulties are met with in hurried repairs to the lower portions of the hulls of vessels in dry dock, where water is constantly dripping from the leaky portion, and owing to the cement inside it is often impossible to stop it in the time available. It must, however, be remembered that metal added by the heat of the electric arc or other method's has not been subjected to the same amount of work as a rolled steel plate or forging. It is, therefore, not so well adapted to take up work suddenly applied, and one would not recommend it for a position of responsibility where such conditions arise. This, however, is a condition generally recognised by engineers with all welds.

The question of the resistance of welds to rapidly alternating stresses and shocks is somewhat obscure. Some year or two ago the author's firm were asked to weld the broken piston rod of a 10 cwt. steam hammer which had already been twice welded in the fire. This was carried out, and is now running satisfactorily. It is not permitted at the present time to refer specially to work carried out, but outside of the boiler repairs, repairs to hulls include the welding of broken stern frames, "A" frames for twin screws and the welding in of a new piece of stem is quite an everyday occurrence.

Boiler repairs are of infinite variety, and include the welding up of cracks to any extent, the welding in of new plates, thickening up of corroded surfaces, and building up of landing edges and defective rivets. Leaky stays and tubes have been welded in position with excellent results, and in cases of trouble with stays with loose washers it is excellent practice to build up from the solid plate to form the washer, which can then be faced off with a special tool.

The superintendent engineer of Geo. Thompson & Co. had carried out the first electric welding repair of any size, being the welding up of a number of cracks in the Purves furnaces of the ss Moravian. This was closely followed up with large repairs to the circumferential seams of the boilers of the Port of London authority's hoppers Nos. 3 and 4. One of our vice-presidents was early in the field, and it was due to his insistence that resistance plant was designed to weld from the ordinary electric-lighting sets of the larger vessels. Generally, however, it was found that the process supplied a long-felt want, and the author's task consisted mainly in seeing that none but fully-trained welders were allowed to undertake any welding repairs. The author's father, Mr. John Kennedy, and his Hamburg colleague, Mr. Bartlett, were the prime movers in introducing the process of the metallic electrode to this country, and the former was a tower of strength when in the early days it was necessary to overdraw at the bank, while Mr. Halket and Mr. Thom were indefatigable in assisting and advising in early experiments.

As referred to above, a number of slides were shown by Mr. Kennedy, illustrating in a general way the type of work carried out and a few of the repairs are shown in the accompanying illustrations.

One of the slides was of the first motor wagon plant used for electric arc welding. The chassis was originally built by J. and E. Hall, of Dartford, to W. A. Steven's patents as a petrol electric motor-'bus, and was the forerunner of the present Tilling-Stevens petrol electric motor-'buses. This machine ran experimentally between Roehampton and Brighton, but was bought by the author's company and the electrical equipment converted to arc welding purposes, still retaining the electric road drive. The same principle was adopted by the War Office for portable searchlights. The chassis is driven by two motors, which engage the driving wheels through a worm drive: in the later machines the driving is from one electric motor, which drives a cardan shaft, and ordinary differential gear to the driving wheels. When the machine arrives at the job the current is switched from the road drive to the welding circuit, so that the same engine and dynamo answer both purposes.

Figs. 1 and 2 show repairs carried out in January, 1912, to one of the Canadian Pacific liners in Liverpool. Fig. 1 shows the defective portion of the flanging of the front end plate cut out ready for welding, and Fig. 2 the completed repairs.

Fig. 3 shows a repair carried out in May, 1912, to one of the Atlantic transport liners at Tilbury. Two tube plates were thus dealt with, and in a number of other furnaces smaller portions were cut out and new pieces welded in. This repair was the most difficult that had been up to this time attempted, as it was necessary to weld the new lower half to the existing half tube plate perforated with holes for the tubes. It was, however, satisfactorily carried out, and has never given any trouble. It may be of interest to mention that nine tube plates have just been similarly dealt with at Cardiff for the same owners.

Fig. 4 shows a repair carried out in November, 1911, to the back plate of the combustion chamber of a marine boiler. The first view shows the defective portion of the back plate cut away, the second, the new portion of plate in position for welding, and the third, the completed job. It will be noted that the plate has been cut through the line of stays, being the method recommended by the surveyors, which is undoubtedly preferable.

Work as if you owned the place—and perhaps you may.—Elbert Hubbard.

TEMPORARY REPAIR OF A BROKEN STOP VALVE

By T. H. F.

An interesting repair of a bad break came under my observation when sailing as 3rd engineer of "S.S.———." We were bound from Cardiff to Nagasaki, Japan, though as we were carrying Welsh coal for the Japanese navy, and Japan then being at war with Russia, our ostensible destination was Shanghai for orders. However, we had come down the Red Sea with its usual discomforts, across the Indian Ocean, and were making up for Colombo to coal. We sighted the harbour about 7 a.m., and about 7.30 the first officer gave orders to the bo'sun to get steam on the windlass, preparatory to anchoring. Now the bo-sun had sailed in steamers so long that he was, in his own mind, something of an engineer. Therefore, instead of notifying the engineer on watch that steam was wanted on deck, he undertook to put steam on himself. The two valves controlling steam to the fore and aft deck were situated in the fidley, at the bridge deck, and easy of access to anyone. The gallant bo'sun, whose engineering knowledge really was all comprised in the ability to turn a wheel to the right or left, which would open or shut a valve, naturally never thought of the fact that the steam had not been on the deck pipes since leaving Suez, so he stepped into the fidley, took the wheel in his tarry hands, gave it a mighty twist, and then things happened. It was here that the chain of events reached me personally. The messroom steward had just entered my room to call me, and I was sitting on the edge of my bunk, rubbing the sleep from my eyes, when a terrific report, followed by the roar of escaping steam burst on my ears. I jumped from the bunk into my engine-room slippers, and in pyjamas and slippers, made for the engine-room. After the first shock my ear could still distinguish the beat of the engines, and there was no sign of steam in the engine-room. Going on the top grating I opened the door leading to the boiler tops, but though the noise was plainer here, there was no steam. As I turned back again, the second came up from below, and made toward the door, beckoning me to follow. He went to the auxiliary stop valve on the port boiler and motioned me to the starboard boiler. These were shut off, and quietness reigned once more. This sounds simple, but any of my readers who have gone on boiler tops in tropical weather clad in pyjamas and slippers will appreciate the pleasure of it. As we came out onto the top grating again, I asked the second what was damaged, and elicited at first a very complete and highly ornamental biography of our bo'sun, bo'suns in general, deck officers and skippers, winding up with the announcement that the donkey boiler stop valve had been blown off. This was the case.

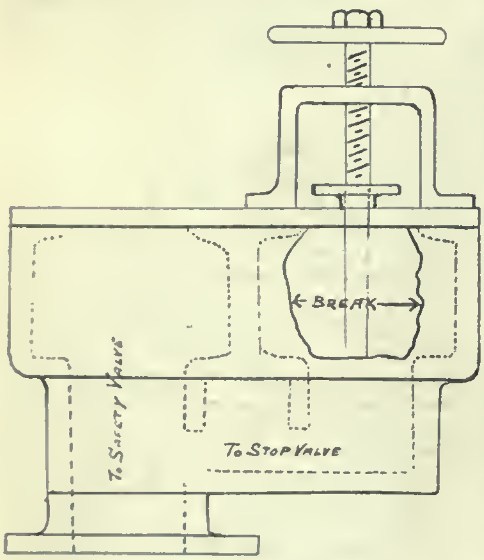


FIG. I—SHOWING BREAK IN STOP VALVE WALL.

Steam for the winches and windlass was taken from the main boilers, through a reducing valve, and from the donkey boiler. The pipe from the reducing valve joined the donkey boiler pipe close to the valves controlling the deck steam. The donkey boiler was situated on the main deck, and from the donkey boiler stop valve to the bridge deck where controlling valves were situated, was about 30 feet in length, with a rise of about 3 feet. Now it was the practice to leave steam when at sea, open on the main boilers to the reducing valve, and up to the fidley, so that if steam was needed on deck, it could be opened without anyone having to go on the boiler tops. As no one but an engineer was supposed to touch the valves on deck, there was no danger. When the bo'sun threw open the valve a slug of water started off, and the first obstacle it struck was the donkey boiler stop valve, which surrendered. The stop valve was contained in the same casting as the safety valve, which made it more awkward. The first thing to be done was to blank the pipe off between the donkey boiler and the supply from the reducing valve, so that steam could be put on deck to handle the anchor in Colombo. This little job being done, a hurried visit to the messroom was paid, where the dried up remains of breakfast were bolted just as the stand-by rang for the pilot. This was the beginning of a perfect day, the remainder being spent between tallying coal and doing little jobs in the engine-room, such as packing the H.P. gland, etc., with the sweat forming pools wherever one stood. The delights of a coaling port ending like anything else, we were under way again about 8 p.m. with the next stop Singapore.

Next morning after breakfast, the chief, second and myself went forth to inspect the damage, and see what could be done. It was essential to have the donkey boiler at work in port, so that the main boilers could be cleaned. The side of the stop valve wall had been blown clean out as shewn by the sketch, but the lower port and safety valves were intact. The cover was good, and the valve itself not damaged. The first thing suggesting itself was to make a patch out of some plate we had, ¾-inch thick, but upon going further into the matter found this would be a job of some considerable magnitude, and other means were looked for. It was finally decided not to attempt a patch, but to use a temporary expedient that would serve till we arrived at a home port, where we could get a new casting. Looking through the stores we found a copper bend 90°, with flanges each end. This was the right size, 4 inches, if I

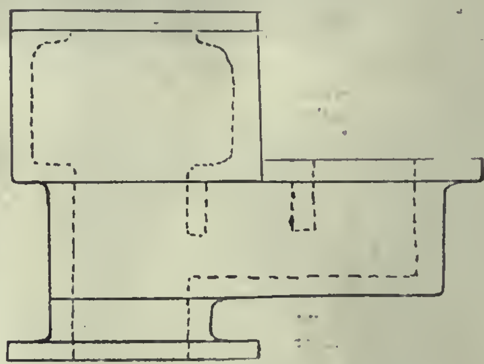


FIG. 2—SHOWS STOP VALVE BOX WELL CUT AWAY TO RECEIVE FLANGE.

remember rightly. The whole casting was taken from the donkey boiler top and lowered down the fidley, and taken to the engine-room vice bench. The broken wall of the stop valve was drilled all round and cut off with a chisel, leaving a flat face. The seat of the stop valve was drawn out, and holes drilled for studs to fit the copper flange. Of course, this took time, as it had to be done by the engineers in the course of their watch off. However, it was finally completed, and the casting replaced. The bend being bolted on to the casting its vertical flange came in approximately the same position as the stop valve flange had been, and the pipe was connected up with a blank flange in between. The method of working was as follows; On arriving in port the steam for the winches would be used from the main boilers during the remainder of the day of arrival. When cargo working for the day was finished, steam was shut off from the main boilers, the blank flange was removed and the donkey boiler lit up, steam being ready for the morning. When getting ready for leaving the modus operandi was reversed. The main boilers would be, of course, lit up and steaming and when cargo was finished the donkey boiler was blown down, the blank flange put in again, and steam opened up from the main boilers. By this means there were no delays, and the time of putting in and removing the blank was about 10 minutes. As we called and worked cargo at Moji, Hong Kong, Moulmein, Fiume, Aggiamarina, Tripoli, Tunis, Tarbis, Holmis, before we arrived at Antwerp, some months later, where our casting was awaiting us, we got quite used to the blank flange drill, and somewhat missed it after the new casting was placed.

GETTING HIGHER SPEEDS AND FEEDS

By D. A. HAMPSON

Any executive will tell you of the persistence of men—other than piece workers—in using speeds and feeds that are too low. There does not seem to be any feeling on the part of machinists to delay the work, yet they do not use their thoughts in an effort to "speed it up," even though it would entail no more exertion on their part. In one plant employing a thousand men the foremen made it a practice to push off a belt when it was on too slow a step of a pulley—this after the men had been instructed carefully and failed to heed; the man at a machine who found his feed belt lying on the floor as the foreman passed was pretty apt to come out of his dream to a realization that the foreman meant business. And by just what reasoning men use a measly fine feed when an additional cut is going to destroy all this lovely finish is hard for an observer to comprehend.

One plant attacked the problem in a different way. Friendly instruction had failed to produce all that it should and it was not the policy of the management to nag the men. Three of the shapers were of the type where a spring pin can be dropped in a series of holes to give feeds from 0 to five teeth on the ratchet. The men persisted in dropping the pin in the one-tooth holes. These were all plugged up—the men grinned and went on with their work. turning out double the amount of chips in the same time; later the work was rearranged so that the rougher class all went to one machine and another hole in it was plugged, leaving a three-tooth feed as the minimum. Soon the men forgot all about finer feeds and turned out just as nicely finished work.

Jobs set up for runs of a day or more were belted up by the foremen with absolute instructions to leave unchanged. Many of these jobs ran for months and at first the men laid all the trouble and inaccuracies to the "speeding up," but as time passed this, too, was forgotten and the men used their common sense in locating trouble. One job on a battery of millers had always been set by a man of experience in that line. Someone else discovered that the cutters could run fifty per cent. faster before they exceeded the book speed for that steel and, though loudly protested by the man of "experience," the results proved the correctness of the change.

On the lathes a similar change was made. Where there was a two-speed shift gear, it was locked or pinned in the fast position. Set jobs were speeded up by changing the feed gear ratio—sometimes this was done at night and the workman never knew the difference. It is enlightening, having tried the thing, how much faster feeds and speeds can be used without trouble when there are none slower available.

GRINDING LEATHER

By D. A. H.

In experimental work and in the course of miscellaneous repair work, it sometimes becomes necessary to machine leather, maybe a friction wheel, or a leather coupling, or a polishing wheel faced with leather. When the leather is stiff, as discs of sole leather between flanges nearly the same size, it can be turned readily and smoothed off with sand paper. But it is not the purpose here to dwell on turning and drilling in the usual manner.

In developing a moving picture machine particularly adapted to the special scenes that the war has given us, a number of rollers were required about two inches in diameter, an inch face, 5-16 in. hole, and with a leather facing less than an eighth in thickness. The periphery of these rollers had to be concentric within .0005 in., smooth and firm. Turning was out of the question—the fuzz and general ragged cut left by a tool demanded a dressing down with sand paper and this destroyed the accuracy, if any. So, merely as a guess, grinding was tried. The first roller was ground in the tool room and was a complete success. A hard, straight surface resulted as if by magic. The same wheel was used that was used for cutter grinding. Later, tool post grinders in the lathe were tried and with an equally pleasing result. No finishing was needed for the emery wheels left a surface as smooth as metal, which needed no touching up and raised no grain, consequently any cut might be a finishing cut and could be micrometered at once.

A CELEBRATION WITH NO BOOZE

The Editor CANADIAN MACHINERY.

Sir:—In my five years' acquaintance with CANADIAN MACHINERY it has not hitherto been my experience to read any editorial which displayed the bad taste and ignorance of yours under the above heading on Nov. 14.

Bad taste because of the reference to England as "weakened by booze" and "in the face of national disaster unable to rise in its might and strangle the slimy thing." This weakened nation, you will remember, raised one soldier out of every six of her population, whilst Canada, with the help of the Temperance Act, finally raised one in sixteen. England has paid a price for victory which we in Canada can never conceive. The smallest tribute we can pay is to refrain from such criticism as the above.

You may be aware that on at least two occasions an attempt was made to force prohibition in England, but was defeated by the common people of the country refusing to work under this restriction of their liberties.

The two battles of the Marne were won, Verdun was saved and the barbarians were finally ejected by the Poilus of France, whose fighting qualities were certainly not diminished by their daily ration of a pint of wine per man.

I can hardly endorse the claim that only those whose strongest drink is tea can be "sober and decent," their language, as shown in your article, is neither the one nor the other, and I enclose my name for the benefit of the writer of your article, with whom I would be glad to debate the matter at any time or place. In conclusion, I would like to refer you to a letter which recently appeared in "Saturday Night," signed by a prominent local manufacturer, affirming that the best class of labor was leaving the Dominion where the liberty of the individual to choose his own form of drink was suppressed and that a repeal of this oppressive legislation was in the best interests of industry.

Yours etc.,

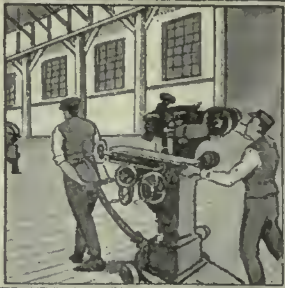
VERITAS.

"The Heating of Houses, Coal and Electricity Compared" is the title of Bulletin No. 6 issued by the Honorary Advisory Council for Scientific and Industrial Research, Ottawa. This publication summarizes the advantages and disadvantages of both the methods of heating, and reduces their cost to an equal basis for a comparative purpose during the past few years and the fuel problem has become acute in Canada, and an idea appears to have been gaining ground that the immense water powers of this great country will amply suffice to meet all heating requirements. The climate of the greater part of Canada is so severe in the winter that even the immense potentialities of its water powers, if fully developed, would be altogether inadequate to cope with the demand for power for electric heating if this were increased to any great extent.

The advantages of electric heating and the difficulties preventing the adoption of electric heating on a large scale are dealt with, and the cost of heating a house electrically at a lowest domestic lighting rate is also given. This cost will be considerably lessened by the use of electricity supplied at power rates, but in this case even, it will not be possible to bring it within the cost of heating by coal.

Factory Finished.—The new plant of the Huntley Co., Tillsonburg, is nearly completed and will be opened shortly. A patriotic dance will be held in it on the 22nd, the proceeds of which will go to Red Cross purposes.

DEVELOPMENTS IN SHOP EQUIPMENT



Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

UNIVERSAL CONVERTIBLE GRINDER

A NEW universal convertible grinder has been placed on the market by the Warren F. Fraser Co. of Boston, Mass. The machine is designed and constructed to meet the exacting requirements of accurate grinding in connection with all classes of fine tools, jigs and fixtures, as well as general production work within its range. Special consideration has been given in designing the tool so as to retain its initial accuracy through a long period of service. All inner bearings of the machine are efficiently lubricated by a tube system with the oil pocket located at the front of the machine.

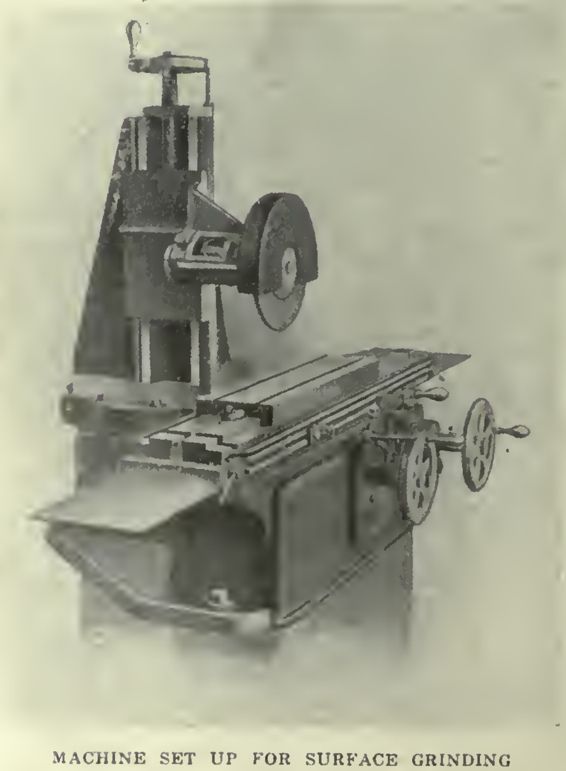
The head stock is of the swivel base type and its bearings on the carriage is of ample length to assure of perfect alignment when bolted firmly against the front edge of the carriage. The head stock spindle is hardened and ground and runs in bronze boxes which are adjustable for wear. The spindle may be set at any desired angle by movement of the swivel base and when grinding parallel work on the dead centres the head can be secured by means of a locking pin. The tail stock is fitted with a liberal bearing on the table, and like the head stock, is clamped to the front edge of the carriage. The spindle is hardened and ground and is operated by the lever action. The carriage is of substantial construction with long bearings on the bed, and fitted with a top table that swings on a central hardened and ground stud, and secured at either end by eccentric binding bolts. Graduated screws are provided for fine adjustment; a scale is also provided at the end to indicate the taper foot and the degrees of the angle.

The wheel slide at the rear is also provided with a swivel base that can be set at any angle, the edge being graduated in degrees. The handwheel actuating the slide is graduated to read to thousandths on the diameter of the work. The wheel spindle is hardened and ground and runs in bronze bearings adjustable for wear. The wheel spindle can also be placed at any desired angle in a horizontal plane, without reference to the angle at which the wheel slide may be located. The cross feed is automatic in its action, the minimum feed being .00025 inch per reversal of table. The machine is fitted with power traverse for the carriage, which operates smoothly and positively, assuring an accurate stroke to the table; the minimum stroke being ½ inch.

Two wheel speeds are provided, 2,700 and 3,800 R.P.M. Provision is made for the traverse table speeds ranging from 4 to 13 feet per minute. The work speeds are five in number, ranging from 130 to 660 R.P.M. The grinder has a capacity of 8 in. by 20 in. on cylindrical work, and 6 inches by 20 inches on surface work with a height of 8 inches, using an eight inch wheel. The machine is fitted with all necessary accessories and weights complete about 1,500 lbs.

A feature of this tool is it convertibilty from cylindrical to surface work. By replacing the ordinary wheel spindle—with its centre on the same level as the work

MACHINE SET UP FOR INTERNAL GRINDING



MACHINE SET UP FOR SURFACE GRINDING

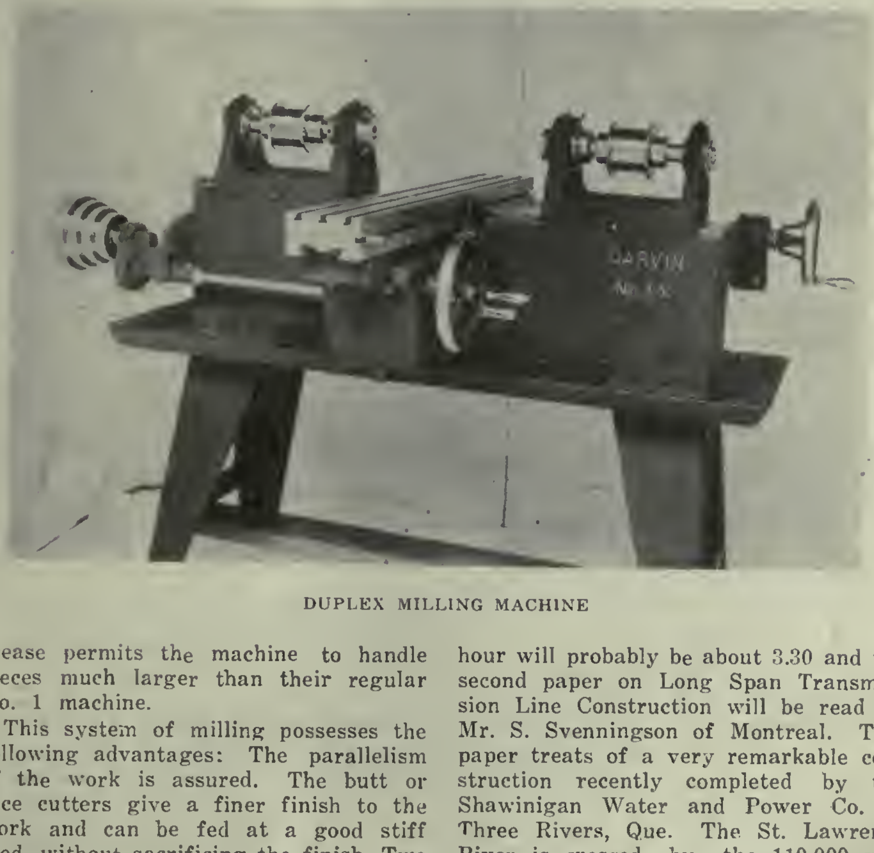
centre—by a specially constructed vertical slide, that carries the movable wheel slide, regular surface grinding can be performed. The spindle on this attachment is identical to that used for cylindrical work. The head for internal grinding is adapted for speeds of 18,000 and 25,000 R.P.M. The Geo. F. Foss Machinery and Supply Co. of Montreal, are the Canadian distributors for this machine.

GARVIN DUPLEX MILLING MACHINE

This is a recent addition to the Garvin Machine Co.'s line of duplex milling machines.

The machine as shown is provided with simultaneous wheel control to the spindle heads so that both heads may be moved at the one time. Provision is also made for independent head adjustment.

The feed of the table is thirty-four inches, while the distance between spindle heads is twenty-two inches. This increase permits the machine to handle pieces much larger than their regular No. 1 machine.



DUPLEX MILLING MACHINE

This system of milling possesses the following advantages: The parallelism of the work is assured. The butt or face cutters give a finer finish to the work and can be fed at a good stiff feed, without sacrificing the finish. Two sides of the work are finished at the same time. There is no scoring of the work such as is due to the drag and spring of straddle mills, as the cutters are close to the end of the spindles and there is no overhang. Work can be stacked up and the same operation taken on all at once.

The machine is designed to meet the requirements of economical and rapid manufacturing of standard articles, such as hardware specialties, brass goods, typewriters, cash registers, etc., the table having ample surface for holding fixtures, power feed, with automatic trip and quick return by hand wheel. Changes of feed are by cone pulley driven from countershaft.

This machine can be provided with pump and piping and is manufactured by the Garvin Machine Co., Spring and Varick street, New York City.

ENGINEERS MEET IN TORONTO

An event of unusual interest in the engineering field will occur in Toronto Nov. 22 and 23. The main Institute meeting of the American Institute of Electrical Engineers will be held in Toronto under the auspices of the Toronto section. It is expected that the members from the eastern States will arrive Friday morning and will be entertained at a luncheon in the Engineers' Club.

The afternoon session Friday will be opened by an address by the president and a paper will be read by Mr. Arthur H. Hull on Electric Power Development in Ontario. After the discussion the hour will probably be about 3.30 and the second paper on Long Span Transmission Line Construction will be read by Mr. S. Svenningson of Montreal. This paper treats of a very remarkable construction recently completed by the Shawinigan Water and Power Co. at Three Rivers, Que. The St. Lawrence River is crossed by the 110,000 volt transmission line wires on a span of nearly 5,000 ft. This is the longest span in the world. Due to the fact that the St. Lawrence is here navigable to ocean steamers, the clearance required is very high and the towers are 350 ft. in height. Since the membership includes many transmission line engineers a very complete discussion of this paper is anticipated.

An informal dinner will be held in the Engineers' Club at which a short address will be given by Sir Robert Falconer. The Friday evening session will include a paper by W. G. Gordon on the Electrical Equipment of the Canadian Northern Railway Tunnel in Montreal, tunnel and terminal electrification in Canada. The work involved in securing an entry into the City of Montreal required the driving of a four mile tunnel through the mountain north of the city and under the business section of the city itself. The 2,400 volt d.c. system was adopted for this electrification.

The following trips have been arranged for Saturday morning:

The British Forgings Co. This great electric steel plant, which is regularly operating ten six-ton Heroult furnaces, is believed to be the largest plant of its kind in the world. Installed in 1917 to fill the demand for shell steel for munition factories, a remarkable record was established by teeming the first melt within six months of the day on which the foundations were laid.

Leaside Munition Co. At present manufacturing shell for the United States Government. This is the largest and most important shell factory in Canada.

Hydro-Electric Substation and Labor-This paper describes the first extensive atories. The substation forms the terminal of the 110,000 volt line which enter the city from Niagara Falls eighty miles away. The present 75,000 kva. transformer capacity, together with the 50,000 kva. capacity in the substation of the Toronto Power Co. are the source of practically all Toronto's light and power. The laboratories, which are adjacent to the substation, are equipped for the many testing and standardization operations connected with the operation of a transmission and distribution system extending over a territory as large as New York State.

At 12.30 noon the visitors and reception committee will meet for luncheon at the rooms of the Toronto Board of Trade. This will be the final activity of the Toronto meeting. The New York train leaves at 5.00 p.m., but it is possible for those who desire to do so to leave on an earlier train and to inspect the work being done at Queenston by the H. E. P. C.

MUNITION WORKERS GIVEN INTIMATION

With peace at hand and the prospects of an early closing of a great many munition factories in Canada, the Imperial Munitions Board is advising all its employees who have chances now to drop back into permanent positions, to take advantage of them without delay. Cards on which are printed this advice have been posted up in many of the departments of the Imperial Munitions Board and before long the employees of all branches will receive this advice. The object is to get rid of those holding wartime positions on the Imperial Munitions Board by degrees.

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IT'S RIGHT UP TO YOU

THERE'S a larged sized chance of the word "reconstruction" becoming a sort of a hackneyed phrase. The word is all right and it states the case, but from much use, if nothing else, the danger comes of its being accepted as meaning very much in general and nothing much in particular.

There is the danger of it becoming so general that it will fail to come home to the individual. After all the work of reconstructon has a very pointed personal application.

The work of reconstruction is primarily the task for the men who have stayed at home. The men who went overseas have done their part. They have paid their price, and now it is up to the homesters to show that they are none the less worthy than the men who went overseas. It may be, even in its worst stages, simply the case of putting up dollars where a few months ago men were putting up lives.

There are firms in Canada that have made money out of the war. They have made thousands, millions. They have stacked up more money than they ever thought possible on the basis of their old lines. They have been doing this while others, brave, strong men, were getting shot at on the battle front. These firms have been enabled to make their millions because these men were courageous enough to go to the front, and having got to the front, to stay there, through all the horrors of war, the slime, the mud, the rain, the frost, the rain of shells and the barrage of steel. All the powers of hell couldn't drive them out. They stuck, and because they stuck the security of the industries at home was protected, and out of this grew the big earnings of the war plants.

Don't think that we lose sight of the triumphs of Canadian skill in mastering the problem of quantity production of shells. Without the shells the man at the front would have been helpless. But the man at the front took the long chance and the $1.10 per day.

Now some of these firms have surpluses from war operations. They are not imaginary surpluses. They are real. They are not dependent on methods of bookkeeping. They exist in a very definite form. They are liquid assets. What is going to be the attitude of the directors and the stockholders? Two ways lie open to them:

(1) This money is an asset that will continue to pay dividends during a period of uncertainty. We can sit tight on it and dribble it out until things come back again. We can refuse to allow it to be used for the development of lines that carry a degree of financial doubt as to their earning capacity. We can play safe with a fund that was piled up while others were staking their all on the western front, or

(2) This money came to us from an abnormal source. It was from the making of munitions. It was our part in the fight. We had the easy time of it while the man in uniform took the raw end. Now that man is coming back and we can use this fund to see to it that conditions are such that he will be able to secure decent employment at a good wage. He will not want charity. He does not ask for a hand-out. He simply will expect that his service at the front will entitle him to the right to live, and to participate in the distribution of monies that were piled up by reason of his devotion to a cause.

That in brief, is the situation. The first option is not reconstruction. It is plain destruction, commercial and national. The second is reconstruction in the real meaning of the word.

There is danger, as stated above, that much use of the word will take from it the point it should carry, will dull the personal touch in it, and make it such a dry-bone affair that it will live only within the covers of government blue-books. If it gets there the word "Failure" will be written over the country just as plainly as the word "Victory" was flashed across the Allied skies a few short days ago.

Reconstruction is real. It means **me**. It means **you**. It doesn't mean simply an academic matter to be spoken of in long syllables. Get this into your mind no matter whether you are a laborer, an employer or a stock holder. "This business is my own concern. There is a part in it for me, and if I don't do it no person else will." Don't jolly yourself into thinking that you can lean back and simply be a spectator in this last great act of the world's greatest drama.

Our idea of hard luck is for the sleeping car porter to lose his whisk before he has made the final round-up of his victims.

It's to be hoped that the peace delegates do not spoil the victory that has already been won by the soldiers on the field.

There will be more wire nails made now. All of which will be quite a source of relief to the bachelor who regards wire nails as his legitimate prey in lieu of pant buttons.

The Germans are now proceeding to surrender their fleet. It should be about as good as new as the British didn't have much chance to muss it up during the four years of war.

The Kaiser went to Holland but is not going to stay. They say he's returning to Germany. If they really want to know how to dispose of him why not turn him loose in one of the Allied countries?

In writing to CANADIAN MACHINERY in connection with a business matter, Wm. J. Kirkham, of Renfrew, says: "I must mention that I am pleased with the quality and variety of matter contained in your CANADIAN MACHINERY; it is sure to become more and more popular with the general classes of mechanics in this country."

PULL THE MEN NEAR YOU UP WITH YOU

Superintendent of the Massey-Harris Co., Toronto, Works Has Had Wide Experience

By A. H. T.

EXPERIENCES of R. W. Gifford, Assoc. Mem. Am. Soc. M. E., go to show that ability to see through the peeling to the fruit pays handsomely. In other words, elusive opportunity struts disguised in all togs, in even the made-in-America raiment of a Pharaoh.

Gifford, at the age of 35, is superintendent of the Massey-Harris Company's Toronto works. His story, as I recall it, follows:

"From when we were knee high," he said, "it was drilled into my brother and I that we should have a college education. Not the easy matter you might suppose; for my father was a minister and ours a good home, a Canadian home up till the year before my birth, but a home in which there was never a plentitude of money. I know I had but forty-three dollars, and I think my brother had forty-eight, when we left for Ann Arbor to attend the University of Michigan.

R. W. GIFFORD
Superintendent, Toronto Plant
Massey-Harris Co.

"The following four years we missed some of the fun, all right. But I believe we learned to do one thing that college boys, as a rule, know nothing about after graduation; we learned to stand on our own feet. Two summers we went out on railroad construction work and in one way or another we paid our way through the University without another cent from home.

"I was twenty-three years old when we graduated in 1906. We had both studied engineering and we went together into the shops of the Olds Gas Power Company, of Lansing, Michigan. We entered on a two-years' apprenticeship at the inconsiderable wage of seventeen and one-half cents an hour, but within the two years we had worked in every department of the shops, and this work had seemed but a continuation of our studies.

"In January, 1908, the secretary-treasurer called me into his office and asked if I'd help him out for a few weeks. His was such a desk as this," Gifford said, indicating his own flat-topped, expansive oak. "He sat at one side and I at the other. And as the books of the company were open to me, mine was a fine opportunity to study financing of business.

"Until November, 1908, I was assistant to the secretary-treasurer, and then made export sales manager. This position itself was at that time created. I was told to rely on my judgment and to work out my own salvation.

"I went South in April, 1909, with an unlimited drawing account and a letter of authority from the Olds Mobile Company as well as credentials of our firm. My duties were more to make a study of conditions in Mexico, Cuba and all South America than to attempt actual selling. I had but two calls to make, as a matter of fact, but I managed to sell more than enough goods to pay all expenses.

Massey-Harris Everywhere

"Incidentally, it was on this trip that I first came into contact with the Massey-Harris Company, Limited. I ran into "Massey-Harris" everywhere, and as they at that time sold Olds engines, a number of the orders I booked specified that shipments should be made through "Massey-Harris."

"One day after my return to Lansing, an Egyptian prince called at our plant, and as his request seemed to be in the nature of export business, he was turned over to me. He was being educated in the States and it appears that his father, a very wealthy Egyptian, had written him that a—I guess you'd call it a plague—was killing off so many oxen there was danger of the land going unplowed. He had evidently told the son to ship him an American self-propelled plow.

No Tractors Then

"But at that time, at least to my knowledge, there was no such thing. However, assured that cost would be no objection, I asked for authority to build a machine for the prince, and I was told to go ahead, but to have it built outside our shops.

"By the last of April, 1910, my tractor was ready. The boys dubbed it 'Gifford's Little Egypt.' My brother went with it to Egypt. Incidentally, as our outside man, he was travelling the world over for export business, which had grown from six engines sold the year prior to my appointment as export sales manager to more than twenty-five per cent. of our total business.

"It so happened that K. H. Deyo, head of a firm at Binghamton, N. Y., which jobbed Olds engines, was in Lansing and saw 'Little Egypt' turning furrows. Later the same day he came into my office.

"'Gifford,' he said, 'I'm going into the manufacturing business and you're going with me.' As this was our first meeting, his was a snap judgment, of course. Nor was I prepared to say either yes or no to his proposal.

"That evening Olds employees were banqueted, and K. H. Deyo sat opposite me at the table. The president's address helped me to a decision; for he dwelt on the desirability of each employee recognizing the limitations of his position—the fact that one could not hope to be more than a cog within the wheels of an organization such as the Olds Gas Power Company. Deyo and I exchanged glances of mutual understanding. I'll be down to see you this coming Saturday, I told him.

"Within a month I was in Binghamton superintending the erection of the Deyo-Macey Engine Company's plant. I designed their complete line of engines.

"And I remember how it occurred to me that soon or late there would be a break between the Olds Gas Power Company and the Massey-Harris Company, Limited. I planned accordingly.

"The break came in 1913. Private—very private—news of it was still ringing in my ears when I reached Toronto. At the Massey-Harris plant, however, I was told that nothing of an intended split was known—so I asked that we be remembered should anything develop, and returned to Binghamton. In March the Massey-Harris company bought out Deyo-Macey body and soul.

"I stayed as superintendent until the first of the year 1914, when I was made secretary and general manager of the Binghamton plant.

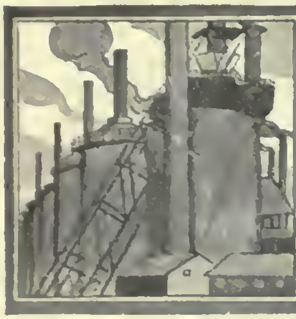
"In December, 1915, I was called to Toronto and given charge of the Massey-Harris shell plant. When we completed our shell contracts in October, 1917, I was made superintendent of these Toronto works."

"And your brother?" was asked.

"You may have heard of the Gifford Engine Company, of Lansing, Michigan," was the answer to our query.

Gifford says: "Take the open door and as you go up, **pull the men near you up with you.** Then if they are loyal and you yourself are fundamentally honest, you are pretty sure to succeed."

Some time ago the Massey-Harris Company, Limited, subscribed to CANADIAN MACHINERY for twenty employees. We cannot say that R. W. Gifford had a hand in that, but knowing the value he places on technical education, we think it probable.



MARKET DEVELOPMENTS

Canada's Part Can Hardly Be Exaggerated

Dominion Has Been the Most Successful Shell Producing Country in the Business—Steel Market Holds Firm, While the Scrap Metal Dealers Are Practically Out of the Market

MUNITIONS business is practically at an end as far as the sale of machinery is concerned. There may be some business yet in connection with American orders, and Canadian firms are sharing in it. In fact one firm was shipping this week on an order it had secured for a quarter of a million in equipment, delivery to be made at an American shop.

Canada's record in the output of munitions is one that can hardly be appreciated. This country has been the outstanding success in the turning out of all sorts of munitions and fuses. In the making of airplanes as well the record has been well sustained.

The disposal of the machinery that has worked in shell shops is a big problem. This machinery divides into three parts—(1) the single-purpose machines that are good for nothing but certain shell operations; these will be scrapped; (2) standard machinery that has been fitted with special attachments for the turning out of munitions—these fittings can be stripped and the machine brought back to its original capacity and style; (3) the general purpose machinery that has been used will, if it has withstood the working of continuous operation, be used in regular production and shop practice again.

There has been a slight reduction in the warehouse price of plate. The price is to-day put at 8c per pound, as against the 10c mark that has prevailed for some months. Ten cents was a fictitious price, and even eight cents is a figure that cannot be maintained when steel gets on a competitive basis once more.

Scrap metal dealers are practically out of the market this week. They do not want to buy anything because they cannot see where they are going to find a ready market for it, and it would be suicide for them to buy for stock out of the present high market and run chances of disposing of their material in a lower market.

There is a tendency on the part of many whose previous training has fitted them only for laborers to want machine positions in the shops now, relying on their war work experience to see them through. In some cases they may be able to do this, but it will not be on work where the training of a machinist is required.

HAILROAD BUYING SHOULD BE HEAVY IN THE VERY NEAR FUTURE

MONTREAL, Nov. 21.—While no immediate cessation of industrial activity is anticipated, the manufacture of munitions in Canada will soon be a matter of history. Plants working on the British shells have received instructions from the Imperial Munitions Board to immediately stop all forging of shells, and plants are given until the 14th of next month to clean up on the machine work, and on this date the production of British shells will cease. Plants working on American contracts are continuing as formerly, as no instructions have yet been issued to suspend operations. Lyalls, who have a large contract for 155 m.m. shells, fully expect to operate throughout the winter, as no announcement has been received to the contrary. This plant has just about completed the installation of equipment and capacity production will soon be attained. It is thought that a large number of men will shortly be required for various branches of government work, including general construction and shipbuilding. An encouraging note is sounded in the remarks of Hon. A. K. Maclean when he states, "There would not be, he believed, the sudden transition and the sharp dislocation of industry, and consequent unemployment and unsettlement that many people seemed to fear."

Peace Affects Steel Production

Production of the early future steel situation is still more or less a matter of guess work, owing to the apparent obscurity that surrounds the general market. That an easier condition will soon be evident is conceded by many, but to what extent is very problematic. Considerable disorganization marks the present progress of events and as a result the situation is very unsettled. This disturbing factor has created a feeling of nervousness throughout the trade and business has been conducted in a very guarded manner. A feature of the armistice has been the reactionary effect upon the munition activity here and many plants are preparing to finish up on their shell work. The steel foundries here have stopped the making of shell billets and forging plants will soon be closed. The railroads are anticipating a renewal campaign, as they have virtually been starved for nearly four years. Rolling stock and supplies have reached a low ebb and expansion is only a question of market conditions. While it is felt that something must be done in the very near future, it is not likely that decided action will take place until some readjustment has been made in the cost of material. Dealers here look forward to a better supply market with lower price quotations. The stoppage of munitions and steels for destructive purposes will undoubtedly react on the general situation as increased raw materials will be available for such mills as have been pressed for supply. The conversion of some bar mills to the rolling of narrow plates will result in considerably more plate production and a return to lower plate quotations. The situation here, however, has shown little relief and the regulations respecting plates prevent dealers from acquiring material for warehouse storage, even should they desire to do so, which few are anxious to do under the present circumstances.

Lower Levels in Metals

Recent events have been an influencing factor in the metal market, but developments so far have not affected price quotations to any extent. With the American fixed price on copper still effective the local quotations will remain firm, although the demand is a little lighter. The tin situation here is rather obscure, owing to inability of getting cables through from London. Shipments of metal are better, but without definite information the market here remains firm. A decline of 2 cents puts the current price at 88 cents per lb. Spelter and lead are both unchanged at 10½ cents per lb. Antimony demand has fallen off and price has declined 2 cents to 13 cents per lb.

Machine Dealers Optimistic

It is quite natural to assume that confusion must reign for a time following the events of the past week, but the optimistic spirit of the machine tool dealer is still a feature of market conditions. It is true that the demand for shell machinery is now a negative quantity, but the inquiries for general equipment that are still coming in does not imply a dormant state of industry. Dealers here report that an increase of inquiries has been noted for tools for marine work, as it has been intimated that some plants that have been engaged on shells may be turned over for the moking of ship accessories. The difficulty of getting tools from the States is still a factor and maintains the high cost of past transactions, but with the weaker demand for shell and ordnance requirements it appears only a question of a short time until the machine tool trade will take on a more normal appearance. In speaking on the possibilities of the single purpose machine after the war, one dealer here thought that there would be a much larger field for such tools, but would probably be restricted to industries where relatively large quantities of uniform product was produced. A feature of the week has been the increasing volume of second-hand tools available and these can invariably be secured at more reasonable figures than formerly. A notable falling off has been shown in the general demand, particularly during the past week. For some time munition plants have been adopting the policy of hand-to-mouth buying and would seldom consider large orders. The shipbuilding interests are still heavy buyers.

Scrap Adjustment Likely Soon

The closing down of shell activity has added to the disorganized state of the old national situation and dealers report a very quiet market. With the copper price still maintained this loss of scrap will likely continue firm for the remainder of the year. Dealers state that much scrap is available, but without a market for it they are not interested, as it would be very unwise to stock up at prevailing prices. They intimate, however, that within the week some readjustment to lower levels are very probable. Present quotations may be considered as nominal.

MUNITIONS BOARD CUT OFF QUICKLY

Sent Cancellation Orders Right on the Heels of Armistice Signing

TORONTO.—The machine tool trade, in common with other industries that were very much influenced by war conditions, has turned from war trade to a very large extent. The reason is that the war trade is nearly a thing of the past, a few American orders being about all that are available now. Other orders, especially from the British Government, are ebbing out in order to disturb the labor market as little as possible. The Munitions Board, had they followed the law of need, would have cancelled the contracts at once, because they do not want or need any more munitions. However it is better policy to shut off by degrees, even if it does cost more money.

There are several questions discussed this week regarding the disposal of war plants. One suggestion is that the government should pick up from the great amount of special machinery, complete plants for making the different kinds of munitions, and store it away as part of the policy of preparedness. It is pointed out that Canadian shell shops know the business thoroughly, and the best of their equipment would be a good investment for the government to keep on hand in some of the arsenals. That is one of the suggestions put forward by a leading dealer.

Plate and Sheets Down

One Toronto warehouse quoted \$8 on plate this morning. That is a direct cut of 2 cents per pound, as \$10 has been the prevailing price for a number of weeks now. This move was not due to any great improvement in the purchasing conditions, but rather was it the outcome of a desire on the part of the trade to get below the \$10 price for plate, which has been more or less of a fictitious value for some time past. Some of the mills on the other side, explained one of the steel dealers here, seem to be in the position now to do the milling if we can go ahead and secure the licenses.

Whether steel prices will find a lower level or not is a debatable question. The case of a concern that produces both pig and ingots serves to illustrate the case. In some cases the yards are full of ore, bought at war prices, which are high. Pig iron can't take much of a slump until that high-priced ore is worked out. The same thing applies to the open-hearth furnaces. High price pig and high price scrap are not going

POINTS IN THE WEEK'S MARKET SITUATION

The steel and coal plants in Nova Scotia have to a large extent been on a peace basis for some time, and no trouble is likely to happen there on the falling off of war orders.

—

It seems likely that orders in this country for 155-mm., 12-inch and 240-mm. shells will be completed. British orders have been cancelled and operations will be entirely suspended in a few weeks now.

—

One Toronto machine tool dealer suggests that the government should take over enough out of the best in the shell plants to be able to turn to shell production any time if the need arose.

—

Montreal reports that the railroads are likely to be very heavy purchasers of machine tools and other equipment, as their supply and repair departments have been starved for months past.

—

Steel plate was brought down to 8c in Toronto warehouses this week, being a drop of two cents. It is still selling here well above the price fixed at U.S. points.

—

Several of the larger dealers in scrap metals report that they are out of the market this week. They will not buy for stock as they anticipate an era of lower prices before very long.

—

Some of the machine tool dealers find themselves quite heavily stocked with supplies that are not good for anything but shell operations. They had carried heavy stocks in order that shell shops could be speedily supplied. The high speed steel in them will bring about 1-16 of the real price.

to be melted and turned into cheap ingots.

The sales end can argue forty different ways to make it apparent that there is not going to be any increases for some time. Against that, though, there is the fact that the purchasing agents are beginning right away to inquire about lower prices, and between these two extremes the real situation will come to the surface in due time. There is nothing in sight at the moment, though, to indicate much depression in price.

A drop is noticed also in the price of sheets. They are now quoted at $9 per hundred, against $10. In fact some of the warehouses have been giving quotation at $12 during the past few weeks. The supply has not appreciably improved. There will not be much betterment in the supply of sheets until the plate programme gets cleared away. Many of the sheet mills have for some time been rolling plate and they are still doing this.

There is a feeling in the steel trade that the War Trade Board should continue in office for some time yet, as the War Industries Board at Washington is doing. It is felt that this would have a sobering effect on the whole situation, and that the government, in this way, could act as the pace maker in the matter of prices. and see that no hardship was worked on any particular dealer.

The Machine Tool Business

Machine tool dealers are turning to other lines than war work. Cancellations have been made in several instances. In fact about the first of these came from the local branch of the Imperial Munitions Board, and in such a way as to throw the dealers into a position where they stand a chance of losing money. The notice sent from the Imperial Munitions Board carries the following clause:

> "If shipment is made after receipt of this advice, same will not be accepted at our stores, and it will be necessary for you to arrange disposal."

That means that a dealer, who may have purchased a machine at some point in the United States, is put in the position of having to secure an immediate cancellation at the point of shipment or bear the loss if he cannot do this. Dealers do not like this idea, and they claim that the Imperial Munitions Board is the one concern that should act, in a time like the present, with a great deal of moderation and tact. The armistice was signed on the 11th, and on the 12th the cancellation notices were sent out.

Several of the munitions firms have inquired of the dealers if they will take back certain supplies, such as hobs, chasers, etc. The dealers have no use for the stuff. For instance a hob that has been selling for around $16, will now be worth about $1 for the high speed steel that is in it. because there is no commercial operation that calls for the use of such a tool. The opinion is put forward in several places that the loss thus saddled on the dealers, the munitions contractors and all handling or using these special purpose supplies, should be absorbed by the trade in general, or in some other way. Had dealers refused to keep a big stock of hobs, etc., the contractors would have been up against it all the time. On the other hand the carrying of a large stock of hobs and chasers enables production to be kept at a high standard. So it is that the dealers, under present arrangements, who carried the large stocks and were always ready to supply the shops at short notice, are going to suffer from their enterprise.

A limited trade is still being done in supplies for shell shops, but the buying is being kept in very close bonds at present. It appears that contracts in this country for the 155-m.m., 12-inch and 9.5 are likely to last for some time yet.

Out Of The Market

"We are out of the market." That was the way in which Frankel Bros. sized up the situation early in the week. "By that we mean that unless we have a destination immediately available we are not buying."

If that position is taken by many of the large dealers in scrap it may have a tendency to force prices to a lower level, especially in sales where necessity figures to any extent. Buyers admit that prices, quoted elsewhere in this issue, while nominally correct, are apt to be misleading because they do not represent the actual money that they are willing and prepared to pay at the present time. Casting copper is weaker in New York, and sales have been made at 24c. This, dealers point out, has a tendency to weaken other prices as well.

Other yards intimated that it was necessary for them to move with a great deal of care. They are looking for a lower level of prices before very long, in fact any purchasers who come into the market, talk lower prices the first thing. "Under present conditions we are not going to buy a single pound of material for stock," was the way another dealer sized up the situation.

SCOTIA PLANTS HAVE BEEN ON PEACE FOOTING FOR MONTHS

Special to CANADIAN MACHINERY

NEW GLASGOW, Nov. 21.—The sudden close of hostilities has set everybody to thinking of normal business and the problems that will attend upon the readjustment from a state of maximum war production to peace conditions. One reassuring feature is that the allied governments have had the problems of demobilization and reconstruction under consideration for a long time, and the rapidity with which the Dominion Government took action and called to Ottawa for consultation the heads of representative industries is an encouraging sign of the readiness of the responsible authorities. Before the armistice was actually signed the heads of Canadian steel companies, railroads and car manufacturers were summoned, and on the day following the cessation of fighting a meeting was held in Ottawa to consider ways and means to turn the manufacturing facilities of the country into ordinary channels of production.

The neighbourhood of New Glasgow contains important railway connections, collieries, steel-works, foundries and a car plant, and it is thus a microcosm of the coal and steel industry and its offshoots. The production of munitions has been a declining factor for many months. For example the employees of the Nova Scotia Steel & Coal Co. now number not much more than half of those employed in 1915 and 1916, and for several months past it may be said that this company has been operating on a peace-time basis. Its plant at Trenton is particularly adapted for the production of ordinary commercial steel products, such as light rails, railway spikes, bolts and nuts. angle iron, structural steel, plates. The manufacture of heavy forgings is a speciality of this plant, and it will be seen that with the demand that is anticipated for railway materials, marine forgings, and building material, there is no reason to anticipate any severe readjustment occasioned by the cessation of munition orders which must naturally now take place. The railways have been starved during the past few years in the matter of rails and rolling stock, and it is further anticipated that there will be a brisk demand for railway cars, and for freight car and locomotive axles, both of which the Nova Scotia Conpany and its subsidiary the Eastern Car Company, are equipped to supply.

At The Dominion Corporation

At the plant of the Dominion Iron & Steel Company in Sydney, the production of shell steel has for several months past been practically discontinued, and the steel output has been largely absorbed in the making of steel rails for the Canadian Government railways. A continuation of this business is a certainty of the near future. The new plate mill, now under construction, should not suffer for lack of orders in view of the tremendous shortage of ships that exists, and must exist for a long time to come, despite the most strenuous efforts of the shipyards. The problem of feeding in Europe does not appear likely to be lessened by the cessation of fighting. It may indeed be intensified by reason of the disorganization of the Central European states, and until the harvest of 1919 is gathered, Europe must largely be fed from this side the Atlantic.

The coal supply question promises to remain acute for some time to come. The production of Nova Scotia is now 31 per

(Continued on page 62)

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	.....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

	Montreal	Toronto
Lake copper	$ 31 00	$ 29 50
Electro copper	31 00	29 50
Castings, copper	30 50	28 50
Tin	85 00	88 00
Spelter	10 50	11 00
Lead	10 50	10 00
Antimony	15 00	18 00
Aluminum	46 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 8 00	$ 8 00
Plates, 3-16 in.	8 50	8 50

WROUGHT PIPE

Price List No. 37

	Black	Galvanized
Standard Buttweld	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19
Standard Lapweld		
2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper, wire	24 50	24 00
No. 1 machine composition	23 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	30 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers ... List plus	20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 ... add	20
Machine screws, o. and fil. hd. brass ... add	25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ... plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws ... list plus	20
Collar screws ... list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ... add 40,	10
Cold pressed nuts to 1½ in. ... add	$4 50
Cold pressed nuts over 1½ in. .. add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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..	$ 8 00	$ 8 25
Sheets, black, No. 10..	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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...	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN
B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck..	2 00
Emery in kegs, American....	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod..	0 38
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra..	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		
Colored.			
Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		
Wool Packing.			
Arrow	25	Anvil	16
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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	...
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

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AND MANUFACTURING NEWS

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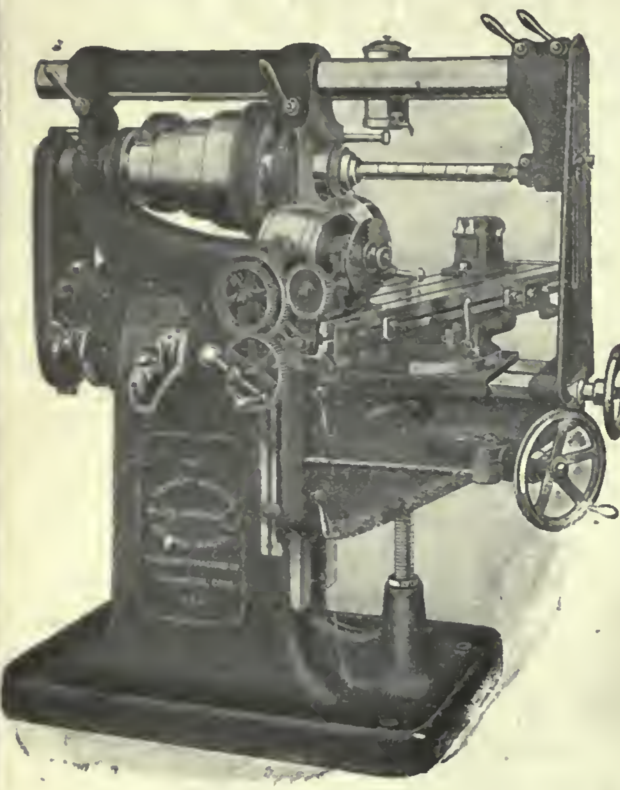
Anybody Can Operate This Miller



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Skilled mechanics are scarce these days—but anyone can run a machine of its simplicity and turn out work accurately and fast without trouble.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XX. No. 22 November 28, 1918

How Marine Cylinders Are Moulded and Cast

The Imperial Munition Board Programme Includes Some of the Largest Marine Engines Ever Built in Canada

By F. H. BELL, Associate Editor

THE molding and founding of cylinders is a subject which never grows old. The art of molding and the science of founding are no where better exemplified than in the production of this class of casting.

As our heading would imply, the class of cylinders to be dealt with in this article is that called for in the orders from the Imperial Munitions Board, to be used on the engines of the ships being built for Canada's new merchant marine.

When it is remembered that the cylinder constitutes the real power of the engine and is depended on to propel the ship thousands of miles from land, it will be readily understood that it must be without blemish.

It must be composed of clean, sound, close-grained iron which will bore out smooth, and be free from defects of any kind either as regards material or workmanship, and lastly it must undergo the pressure test and be O.K.'d by the Marine Underwriters' inspector. From this it will be easily appreciated that every one who is in any way connected with its construction is directly responsible for the results. The quality of the metal purchased, the purity, of the fuel used in the melting of it, the manner in which it is melted, and the temperature at which it is poured, coupled with the skill of the workmen who perform the work of molding and core-making, and the untiring efforts of the superintendent and foremen who see that workmen are provided with proper equipment and material, all contribute to the success or failure of the casting.

Through the courtesy of the genial Mr. Wingate, general manager of the Gurney Foundry Co., and Mr. McCormick, the general superintendent, we are enabled to give a fairly detailed description of how this intricate class of work is done at their plant in West Toronto.

The method adopted is similar to that commonly employed in molding stationary cylinders. The pattern is parted in the middle and molded and poured lying on its side. Complete iron flasks are used. These flasks are one inch in thickness and well reinforced with ribs. They are all interchangeable and range in size from 9 feet square down to any size required for smaller cylinders.

Trunnions are provided for convenience in rolling over. Permanent pits are provided some 12 ft. square and 5 ft. deep in which to make the mold and pour it. These pits are not used in the ordinary sense of foundry pits, but are simply used to bring the mold down low enough for convenience in molding and pouring, as well as providing backing for braces to support the mold against straining under pressure of metal while being poured. The space between the flask and the walls of the pit, allows ample room for the workmen to walk about while working on the drag, and the walls also provide good foundation for scaffolding while ramming and finishing the outside of the cope. Before proceeding further it is as well to explain that these molds are all made in dry sand. The facing used is composed of 3 parts old molding sand and 1 part new, mixed in the proportion of 12 to 1 with black core compound, to which is added a keg of pine saw-dust for a batch big enough for one mold. No flour is used; the black compound taking its place, but thin clay wash is used with which to temper it. In beginning to make the mold the smooth follow board is placed on the bottom of the pit, and the bottom half of the mold proceeded with as in all green or dry sand work. The pattern and follow board are covered with a few inches of facing sand and well rodded and nailed wherever a rod or a nail can be utilized to any apparent good purpose, after which it is backed up with heap sand, and properly rammed and vented. A staunch iron plate an inch thick constitutes the bottom. This is bedded on and pounded to a perfect bearing with a sledge and securely bolted, after which it is turned over by means of a powerful pneumatic crane, in less time than it takes to tell the tale. The cope is rammed up in a similar manner and lifted off by this same pneumatic crane and rolled over on its back.

FIG. I—Drag for 54" low pressure, slide-valve cylinder. Note clay balls on bottom of barrel to show thickness of metal after trying in core; also chaplets separating steam chest and port cores.

The patterns are drawn with the crane after which the mold is finished and black-washed placed in the oven and is thoroughly dried. These molds are not skin-dried but are dried from top to bottom, making a hard, open-grained, yet smooth-faced body for the iron to lie against, equal in every respect to a loam mold. The saw-dust opens the pores of the sand similar to a loam mixture, while the compound and the clay wash hold it firm. After being dried and sufficiently cooled to be handled, the drag is returned to the pit, where it is rubbed

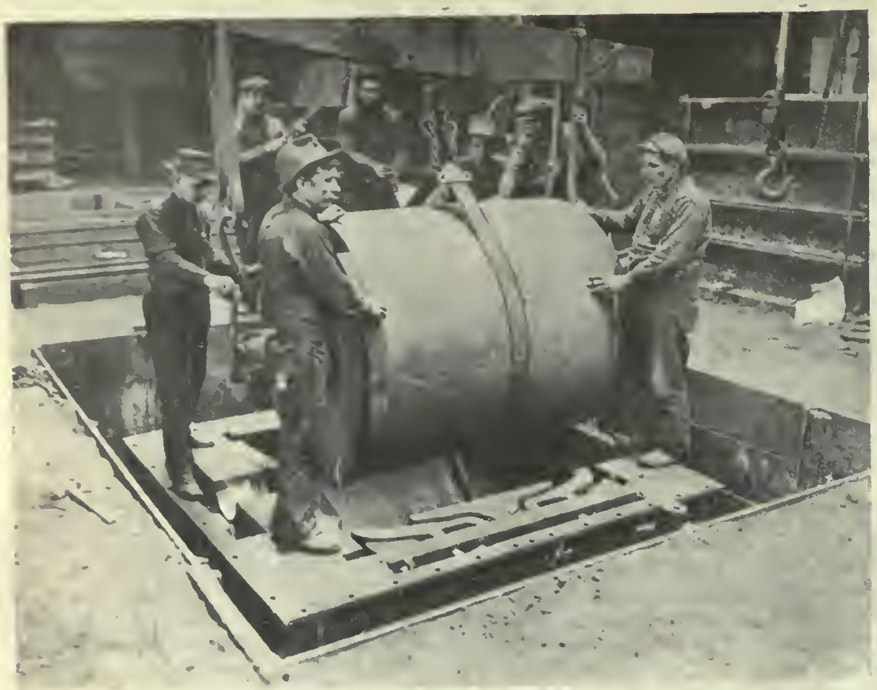


FIG. 2—CORE BEING LOWERED INTO PLACE. SEE COPE TO RIGHT SHOWING MANNER IN WHICH SECTIONS ARE BUILT TOGETHER, ALSO SHOWING SYSTEM OF VENT HOLES.

perfectly smooth by means of waste, soaked in coal oil, and finally finished with dry plumbago. It is now ready to receive the cores which form the interior of the cylinder as well as the various ribs and branches on the outside.

Fig. 1 shows drag for low pressure slide valve cylinder with bottom half of steam-chest and port cores, also bottom half of core which forms the flange for stuffing box, as well as the ribs for strengthening lower head of cylinder and the brackets which support the cylinder on the upright columns. Fig. 2 shows main core being lowered into place in the drag. Fig. 3 shows top half of core being lowered into place, showing how end of cylinder will appear. Figs. 4 and 5 show different views of high pressure cylinder, showing it to have round piston valve.

The making of the cores is of equal importance with the making of the mold. The sand used is pure sharp sand, brought from the shores of Lake Erie and is mixed with linseed oil in the proportion of 1 to 16.

The making of the main core shown in Fig. 2 is of interest. It is made in halves, being swept up on flat plates and dried, after which it is carefully jointed and pasted, appearing as in Fig. 2. The arbor shown in Fig. 7 is placed on the plate and filled tightly with coke, after which the core sand is rammed around it until it is of a sufficient size to be swept to the exact shape and dimentions. The bolt holes marked A.A.A., Fig. 7, are used to bolt the two halves together, and when bolted in three places it makes a core as rigid as though it had been swept on a barrel arbor. The other cores are made in core boxes from the same mixture and are suitably rodded and vented. This is not difficult, as the oil cores are strong in themselves and when burned, very little gas is generated.

The setting and securing of the cores, is undoubtedly the most particular part of the entire job. They must, not only be properly placed but must be secured against being shifted or floated by the force of the incoming metal. The system adopted by Mr. James Douglas, who has charge of this department, assisted by his able aide, Mr. A. E. Scott, leaves no room however for fear. To demonstrate more clearly we will go back to the ramming of

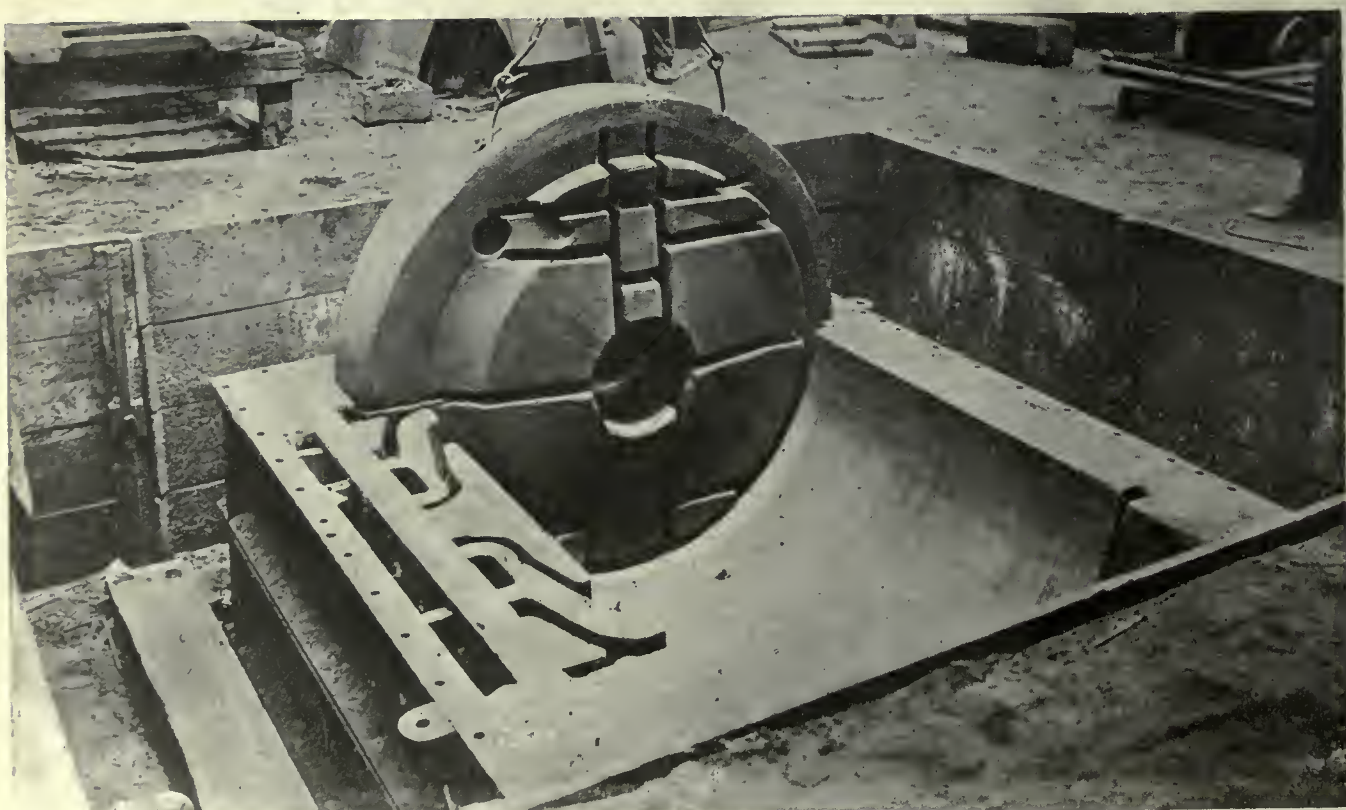


FIG. 3—TOP HALF OF HEAD CORE BEING LOWERED INTO POSITION TEMPORARILY. STUD CHAPLETS IN BARREL IN PLACE OF CLAY BALLS, ALSO SPACE BACK OF CHEST CORE TO FACILITATE TYING CORES INTO PLACE AS WELL AS ALLOWING FOR ESCAPE OF GAS FROM CORES.

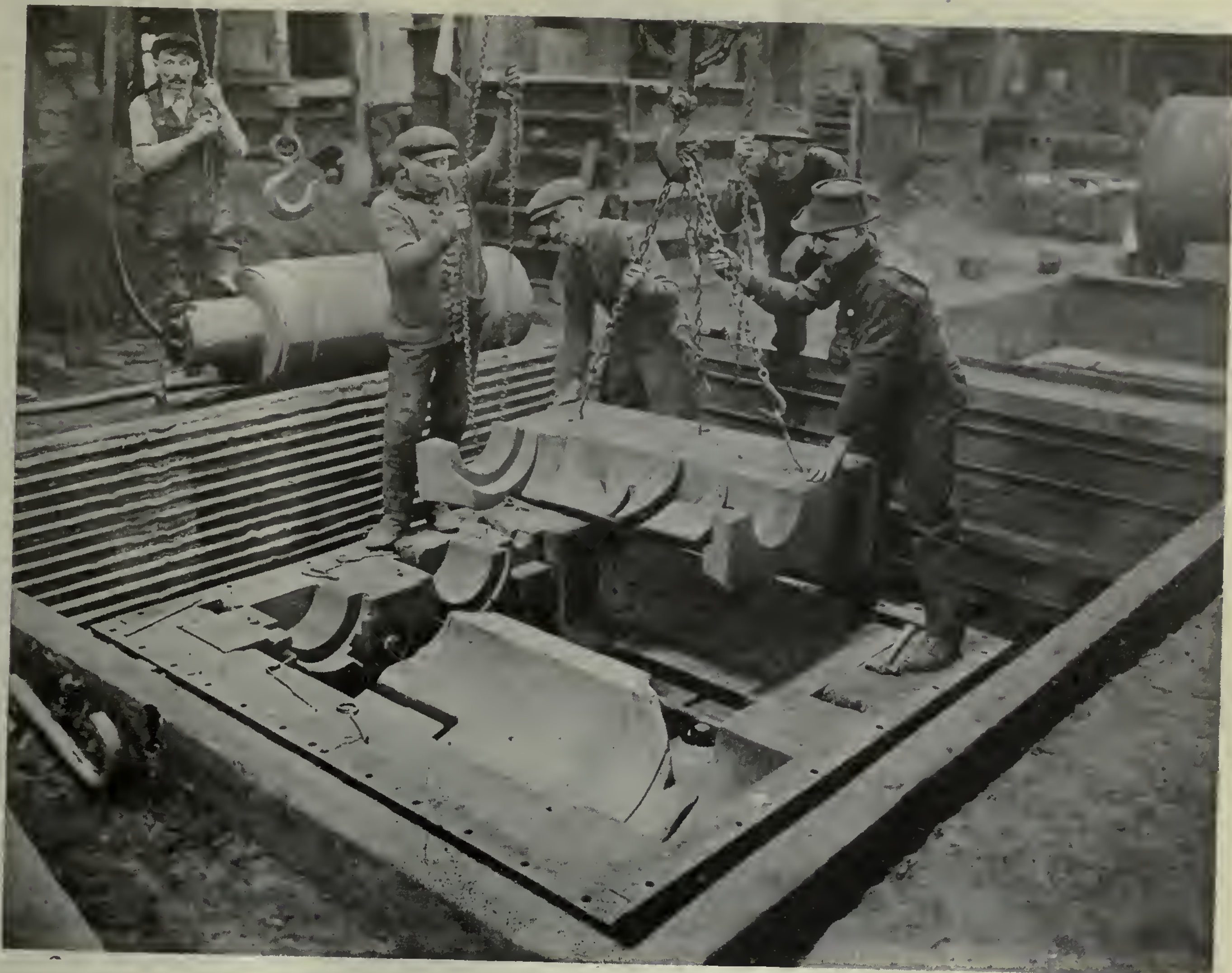


FIG. 5—CORE BEING LOWERED IN PLACE IN DRAG OF HIGH PRESSURE PISTON VALVE CYLINDER.

the drag. It might be explained that the drag has bars similar to the cope to assist in resisting strain. While the half pattern and the drag were on the follow-board preparatory to starting the mold, irons are placed tight against the patterns wherever a chaplet will be required and securely bolted to one of the bars. When the pattern is withdrawn later on, these irons will be seen even with the face of the mold. When setting the cores, balls of clay are placed on these irons, and the core is tried in, temporarily; by so doing the clay balls are pressed into exact thickness required, and a stud chaplet of the size indicated by the clay is placed upon the iron in place of the clay. Stud chaplets are also tightly fitted between cores and side of mold and also between the cores themselves.

In addition the port cores and the steam chest core supporting them are securely tied through the back of the steam chest core-print and onto the outside of the flask. The top half of end core, shown in Fig. 3 is not put into that position until after the main core is placed, when it and the top halves of the steam chest and port cores are put in their proper position and clay balls placed wherever a chaplet will be. The cope which also has irons fastened to the bars to hold the chaplets is now tried on and lifted off and the proper sized chaplets put in place to hold the cores down, and also to keep them the right distance apart.

The manner of securing them from the side is different in the cope from what it was in the drag, it not being possible to place studs. Long chaplets are held loosely and drawn towards the outside until the cope is closed

FIG. 4—DRAG FOR HIGH PRESSURE " PISTON VALVE CYLINDER." NAILS DRIVEN INTO HEAVY BOSSES ARE TO PREVENT SHRINK HOLES FROM UNEVEN COOLING.

FIG. 6—CORE ROOM AND OVENS, SHOWING OVERHEAD CONVEYORS AND CHUTES FOR DELIVERING CORE SAND FROM SAND MIXER AT THE LEFT.

down for the last time, when they are shoved home against the core and securely wedged as shown. As will be readily understood, when the mold is clamped together, the cores are automatically clamped into place and no strapping down of chaplets is required as is common practice, but as an extra precaution wedges are driven from the outside between the cope and the top of the cores and in addition to this, staunch L shaped irons with toe on A, Fig. 7, are securely bolted to the flask, and resting upon the top of the bolt lugs of the main core arbor hold it firm. When the clamping and wedging is completed, vent rods are connected with vent holes in the different cores on the parting and project out through holes seen on outside of flask. After this the open spaces seen at Figs. 1, 2 and 3 are filled with molding sand, securely rammed in.

The manner of gating is also an interesting feature. Pop gates are used exclusively. These gates are made in cores and are about five-eighths by three inches and of sufficient length to saw off whatever length is required. They are placed on top of the steam chest flange and also on corner flanges on the opposite side. Good judgment must be used in placing them so that the iron will not strike any vital spot. To accomplish this they are arranged so that the iron drops into the bottom flanges. (Out of 150 cylinders made for I.M.B. engines and ranging in weight from 8 tons down to 3 tons not one has shown any sign of cutting from the iron falling this distance). The gates are connected on top by basin running the entire length of the mold and two 5-ton ladles are used in pouring. Abundant metal is flowed through the risers to insure against any possible kick from cores, doing harm and also to carry off any dirt which might have, through any means, been in the mold.

The mixing and melting of the iron is under the personal supervision of the foundry superintendent, Mr. James Gilson, and is the same as is used for the Gurney Fdy., Co.'s hot water boiler castings and is all pig iron bought only by analysis. The mixture found to be most suited to the work analyzes approximately silicon 2.40, sulphur .03, phosphorus .60, manganese .70. The resultant castings will be silicon 2.05 and sulphur .07.

Solvay coke is used as a rule but 72-hour coke is sometimes used. The secret being to use enough to have the metal properly melted.

When we consider that what is termed a steam cylinder, consists of, not only the cylinder itself, but includes the steam chest and valve seat with two sets of live steam ports, exhaust steam port with pipe opening and flange leading to next cylinder as well as the pipe opening and flange for live steam intake. Also bottom head of cylinder with all of its ribs and branches, small opening with flange to receive stuffing box, and to this add the bracket to which the columns are fastened, and the branches to which the lagging is attached, we may well say that to accomplish all of this without defect requires equipment and material of the highest order and mechanics who take second place to none. The name of "Gurney" is too well known in Canadian foundry circles to require further comment.

It was our privilege to see these cylinders machined and tested as well as inspected by Lloyd's Inspector at the Engineering Works of the John Inglis Co., where some of the engines are being built and we know whereof we speak. They were first-class castings.

ELECTRIC FURNACES

The Electric Furnace Co., Alliance, Ohio, have recently issued four bulletins descriptive of their various makes of electric furnaces. These furnaces work on the resistance principle, carbon resisters held in refractory troughs being used. The flexibility of this arrangement is such that the furnaces may be adapted to almost any use, and in sizes up to those big enough to take naval gun liners and jackets in vertical direction or ships' rudders in the horizontal.

The precision required in the production of all war materials, especially airplane, shell and gun work, has given the electric furnace a field of extreme usefulness, and one which promises to be capable of considerable development in peace-time industries. In this field the furnaces described are particularly useful, the accuracy of heat control being especially desirable. Hardening, quenching, and heat treatment are all done automatically. The melting of nonferrous alloys is treated of in two of the publications, and furnaces of large and small capacity are described, and data given as to their operation and efficiency.

The Independent Pneumatic Tool Company, of Chicago, have recently issued their circular, No. 28, which describes pneumatic and electric tools. Portable grinders, both of the electric and air operated types, are illustrated; drills are shown and floor and bench hammers for foundry work are illustrated and described at some length. The floor pneumatic hammer is shown in many of its newer developments. The circular is of interest at the present time in view of the activities being carried on in the shipbuilding industry.

FIG. 7—One half of core arbor for main core, showing curved iron enclosure for coke. The lugs marked A with bolt holes for fastening the two halves together, project through the core and are securely fastened to the flask, making the core perfectly secure.

Fundamentals of Beam Theory and Calculation

Action of a Beam Under Load—Bending Moment Explained—Simple Rules For Determining the Strength and Stiffness of Beams—Shear in a Beam

By D. A. HAMPSON, Assoc. Mem. A.S.M.E.

ON the subject of Strength of Materials, a "beam" is any part having one or more supports and acted upon by some force outside of the supports. If the force acted directly over the supports that portion of the beam would be subjected to tension or compression only and would be so considered mathematically—but when an overhanging part of the beam is loaded, the stresses set up must be calculated in a different manner. The "beam" may take various forms—it may be a steel beam for a crane runway, it may be the head block that takes the thrust in a straightening press, a bar of steel used overhead as a temporary fastening for a chain block, or the everyday wooden beam of carpentery.

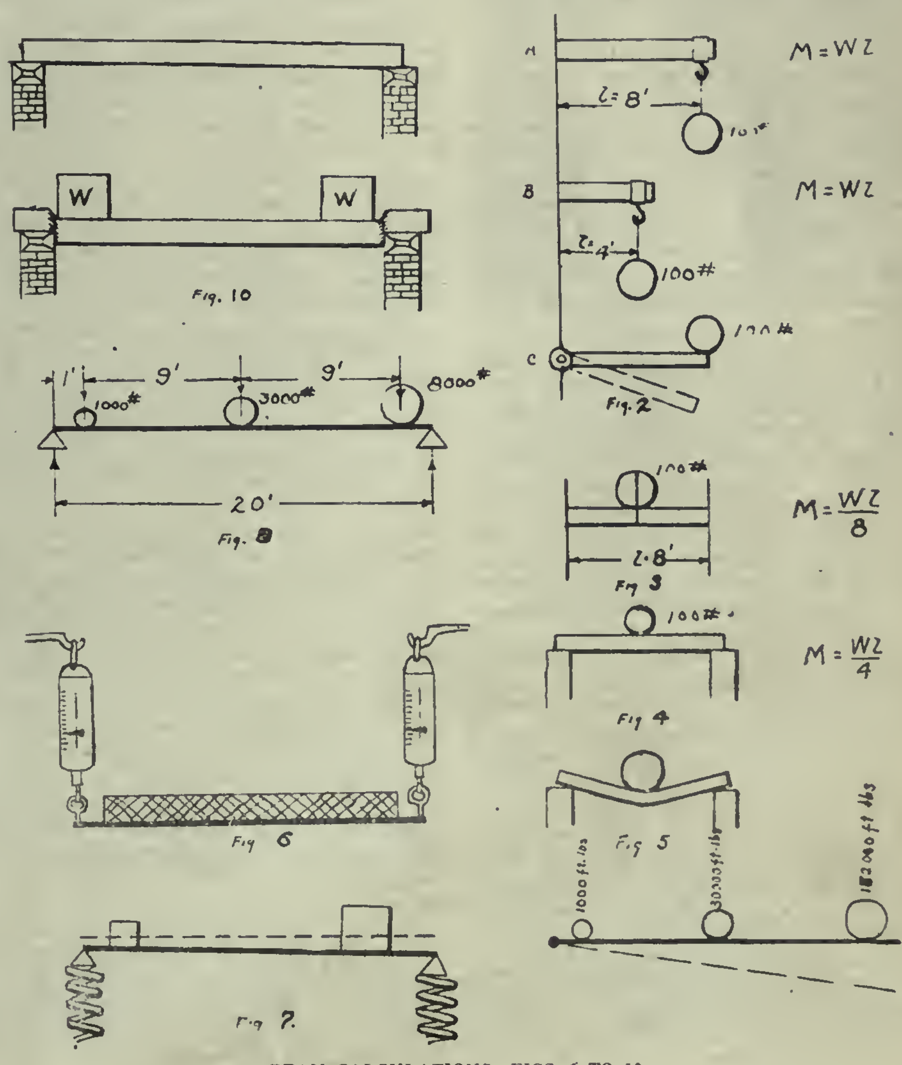
Fig. 1 is a typical beam, but one without any load. There is the load due to the weight of the material in the beam itself, but for short spans this is neglected; in many other calculations the weight of the material is not considered or, if it is, the designer adds an amount to the calculated sizes to cover this; in long and important spans this weight must be considered and to facilitate the work, those handbooks issued by steel companies rolling standard structural shapes give the properties of those shapes in terms that include the weight of the material without further calculation.

Unless acted upon by some external forces, the material of which the beam is composed is practically at rest, it having to resist no change of form except that due to its own weight. But when forces—which may be weights or other loads, pressures, or falling bodies—act upon the beam, it is stressed sometimes to the point where it breaks or is permanently deformed. Some shaped beams resist stresses better than others and the way a particular beam is turned makes a great difference in the resisting power, as for instance, an I beam is stronger resisting upright on the flat of one flange than it is if turned 90 degrees so it rests on the edge of both flanges. From the way a beam is turned and from its shape, the "section modulus" is calculated—this is the resisting value of the cross section and it, multiplied by the strength per square inch of the material, is the value used as one member of the beam equation—the "resistance member," it might be termed.

Nearly all beams will bend before they will break. The "bending moment" due to any load is the amount of that load multiplied by its distance from a support—a weight of 1000 lbs. placed 10 ft. from the support, creates a bending moment of 1000x10=10,000 ft.-lbs. In order that the beam be strong enough to stand up without breaking, the resistance member noted in the preceding paragraph must equal this bending moment and the calculation becomes that of solving an equation, one side of which is the resistance of the material in the beam section and the other side is the moment of the load on the beam. The unknown factor may be on either side of the equation. Also, both members of the equation must be in terms of the same denomination, that is, in either inch-pounds or foot-pounds (or inch-tons or foot-tons).

The moment of any force is its turning value about a point; in the case of a beam the point is the edge of the support. At C in fig. 2 is shown a cantilever beam which is hinged at the point of support to make the theory of bending moment more clear. With this hinged beam when the load is too great for the resistance of the joint to keep it up, the beam turns about the pivot and assumes the position of the dotted lines—the force exerted at the joint to make it give is found by multiplying the weight by its distance from the joint, and this value is the bending moment. If this bending moment were put in a beam equation the other member would be the frictional resistance of the joint instead of the resistance of so many square inches of metal of known strength which would be the value used in the case of an actual beam supported (not jointed).

But the same load does not always produce the same bending moment, as witness the cases of fig. 2, A and B, and figs. 3 and 4. All of these beams have a weight of 100 lbs. at a given distance



BEAM CALCULATIONS—FIGS. 1 TO 10

from the support. The maximum bending moment is denoted by M in all calculations. In fig. 2, A and B, the maximum bending moment is the product of the weight times the distance, but as the load is only half as far from its support at B as at A, the value of M will be only half as great in the former case and the same size of beam would be therefore twice as strong against bending. The beams A and B are cantilevers and, like all such have but a single support, so that they must be fastened, or "fixed" at that support to prevent tipping.

Fig. 3 shows a beam fixed at both ends and having a weight of 100 lbs. in the center. Though the load and length are the same as at A in fig. 2, the bending moment is only one-eighth as great. A little consideration will show that this is as it should be: if the beam and the load were divided by the vertical line we would have two cantilevers 4 ft. long with a 50 lb. weight at the ends and M for each would equal 4 x 50 = 200 ft.-lbs., but as actually the beam is not divided at this point, but is continuous, the value of M is even less, as proven by a solution of the formula, which shows M to be 100 ft.-lbs.

The beams heretofore considered have had their ends fixed; in practice, this may take a variety of forms, such as bolting or riveting to framework, set in masonry, or weighting. Other things being equal, the beam with fixed ends is stiffer and stronger than one not so fastened. A beam merely resting on supports is shown at fig. 4. The accompanying formula shows that it has a bending moment twice as great as the same beam with fixed ends—consequently it would bend under a load but half as great. Fig. 5 shows why this is so and what happens to an over-loaded beam that does not have the ends fastened.

Only a proportion of beams have loads such as just shown. Many have a number of loads, as the beam in fig. 3, others have a uniformly distributed load throughout their length, as the beam in fig. 4, while still others may have a combination of uniform loads and concentrated ones. All works on the mechanics of materials give the formula for M (the maximum bending moment) for various conditions of loading, figures 2, 3, and 4 being three of the most frequent conditions. Usually in designing a beam the length of the span is known, as is also the kind of support and the loads; the proper formula for finding M is then selected; the general shape of the beam is known and so is the strength of the material to be used from which is obtained the resisting moment, leaving the actual dimensions of the beam to be determined from the section modulus. As the resisting moment must equal the bending moment, these two are equated and the formula solved for the unknown term, which is the section modulus. Thus for the beam of fig. 3, of steel, rectangular with the long axis vertical, the processes would be—

$$M = \frac{W\,l}{8} \ \&\ M = S\frac{I}{c}$$

then

$$S\frac{I}{c} = \frac{W\,l}{8}$$

Substituting

$$60000\frac{I}{c} = \frac{100 \times 8}{8}$$

or

$$\frac{I}{c} = \frac{1}{600}$$

As the section modulus for a rectangular beam is

$$\frac{b\,d^2}{6}$$

the proportions of breadth and depth may be determined by trial from the value just found. For simplicity in the above, a factor of safety was left out and the breaking strength of the material used; in practice, the value 60,000 lbs. per sq. in. would have been divided by the factor of safety before using in the formula or else the factor would have been included in the formula, making it

$$M = \frac{S\,I}{f\,c}$$

Reactions are of great importance in beam calculations. Turning again to fig. 1, each of the piers supporting the beam bears a part of the weight of the beam and of any loads that may later be put upon the beam. If a single load be placed in the middle or several loads are placed symmetrically, or there is a uniform load throughout the entire length, each pier will bear one-half of the total load—in technical language, "the reactions will be equal."

It is not always clear to the beginner why this load on supports is called by the name of reactions. Referring to fig. 6, we have a beam that is suspended from spring balances instead of resting on supports. Assume for convenience that the beam itself has no weight. Then unless there is some load put on the beam, the pointer of the balance at each end will stand at 0. But when a uniform load is added throughout the length of the beam, each pointer drops an equal amount on its dial and indicates one-half of the entire load. This registered amount is the reaction—the springs within the balances are under tension due to the load and are resisting that load by pulling back (upward) as hard as they can, but they have been forced to stretch to the amount shown on the dial; but should the load be removed, the springs would immediately return the pointers upward to the original position.

Though loads may act in any direction it is customary in plotting them to arrange the drawing so they are acting downward. Then the reactions are upward. But in any case the reactions are opposite in direction to the loads which, in the average drawing, makes them to act upward.

It is very plain that a load on a beam exerts a force that has more or less tendency to bend the beam, but it is not so easy to conceive the reactions as a force. The experimental case of fig. 6 does show this; fig. 7 shows it in another way. Here, instead of solid supports under the beam, we have a compression spring under each end. Normally the springs are extended, but as weights are added the springs are compressed more or less, according to the amount and position of the weights. The reactions of the springs would be upward if the weights were removed just as would be the reactions of solid supports, though it would not be possible to see the latter "react" as it would be with the springs. When loaded, every beam creates a reacting force in the supports which would equal the amount registered on a dial of a spring of the form in figs. 6 and 7 could be substituted for the solid support.

The weight to the right in fig. 7 is larger than the one to the left and this compresses the right hand spring more than the other, hence the right hand reaction is greater than the other. Just what proportion is borne by each reaction could be told in every case by a direct reading on the dial of a spring balance, but this is not a practical construction, so a calculation is necessary for every-day work. The dash line in fig. 7 shows the position of the beam "unloaded" and shows graphically that the greater reaction is at the end bearing the larger load.

Fig. 8 is a typical case of a beam with three loads, where it is required to know the reactions at the supports, i.e., how much of the total load each support bears. The method of doing this is very much like that of finding the bending moment of a beam as described in a preceding paragraph. Either support may be selected as a center about which moments are taken. Take, for instance, the left support. Then the moment of the first load out on the beam is 1000x1=1000 ft.-lbs., of the second load 3000x10=30,000 ft.-lbs., of the third load 8,000x19=152,000 ft.-lbs. Adding these we get a total moment about the left support of 183,000 ft.-lbs. How this would act is made plainer by studying fig. 9, which shows the left support as a pivot and which has the right support entirely omitted; these loads would cause the beam to swing about the pivot as shown by the dash line.

The question is, "How much would it take at the extreme end of the beam (the point of action of the right reaction) to keep the beam up in a horizontal position?" This load of 183,000 ft.-lbs. is resisted by a support 20 ft. from the pivot, therefore it bears

$$\frac{183000}{20} = 9150 \text{ lbs.}$$

of the total load—and this is the amount of the right reaction.

The sum of both reactions must always equal the sum of the loads. So the left reaction may be found most easily by subtracting 9,150 lbs. from the total of 12,000 lbs., which gives 2,850 lbs. as the left reaction. This could also have been obtained by taking the right support as the pivot, or center of moments, and computing as before from that end. The result is the same in either case.

If the beam of fig. 8 had been supported on springs as the beam of fig. 7, it would have tipped at the right end just as the latter, showing that the greater load produces the greater reaction when so placed.

It is necessary to know the reactions in order to determine if the beam is strong enough against shearing. Fig. 10 shows a beam with a heavy load placed close to each support. Fig. 10 placed close to each support. The material of beam has not been strong enough and the loads and supports have become a veritable shears and cut the beam at two points. Such failures occur in machinery frequently; in structural work they occur as collapsing or crushing at the support, the conditions being such that this takes place instead of actual cutting off as with machine parts.

In more extended beam calculations, "shear" plays a prominent part and tells instantly a number of points which bear on the calculations. Shear is greatest at the point of support; however, though a beam would actually shear off only at this point, the numerical value of the shear is the same all the way from the support to the nearest load. If there were a single load in the center, the shear would be the same all the way out to that load —this is important for mathematical purposes; and it is interesting to note that at the exact center of the beam the shear is 0 while at this same point the bending moment is greatest.

LUBRICANT ECONOMY

By D. Street

One of the minor troubles in the mechanical business at the present moment, which is certain to become more acute as time advances, is that of lubrication. Oils, fats and greases, of whatever origin, do not increase and multiply. They grow scarcer and dearer. The troubles in this respect in enemy countries are their own, and it is certain that rolling stock of all kinds must be in a deplorable condition there owing to the blockade, and this matter alone is forcing the pace with regard to Rumania and Russia. Lubricants are as essential to the conduct of war and transport as food. With a shrinking tonnage available, importation must inevitably be restricted further still, and there is no natural supply of oil available in many countries. Tallow, lard, mineral oils, as well as those of vegetable origin, are all in like case. The shortage of edible fats has led to rationing these equably to the population, and practically the whole available supply of vegetable oils can be considered as withdrawn for food purposes in Great Britain.

Out of this shortage and scarcity arise several matters worth mention; the first of these exerts a natural check upon consumption; prices are rising steeply. The second matter is that relief in this particular cannot be expected; indeed, the conditions of scarcity will prevail after hostilities cease. Conservation of existing stocks therefore must be rigidly practised.

So far as possible all wastage should be avoided. In the normal shop quite half the expenditure upon lubricants is thrown away; every unit in the shop force should, as a point of honor, contrive to use as little oil as possible. For instance, the use of the oil can to drill a hole, or on any machining operation should be barred; it's up to the storekeeper to ration the supply with the strictest economy. The management should display in a conspicuous place warnings upon the matter, taking the percentage increase in cost and the need for rigid economy, of the national stocks.

Most moving mechanism can be efficiently lubricated with about half the considered normal amount. Where drip lubrication is in use a little careful investigation will show how to cut expenditure of lubrication. In deed and fact, without being parsimonious, and without grudging the needful supply, the drops per unit of time can in many instances be halved without danger of rise in temperature.

It was an experienced operating engineer who maintained from experiment that doing his own oiling round he cut oil bills 33 1-3 per cent. Bearings of common type, unprovided with drip trays, needing adjustment, and with surfaces in poor condition, require much more oil than those under the reverse conditions. To compensate and spin out the supply, and so save tonnage, every piece of greasy waste should be treated to recover the oil; a small centrifugal extractor and filter pays large dividends in a big works.

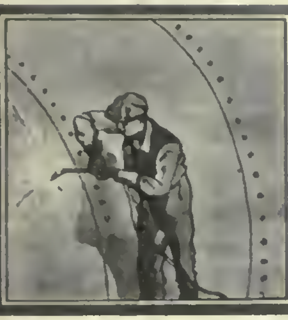
Care should be exercised over the oil can to see that this is in good shape and not leaky. One way in which the mechanical trades, and every man in association therewith, can help victory is to be sparing with the oil can. Owing to the fact that ball bearings need but one filling of grease, and this simply to exclude the grit, over a long period of time, the present high price of lubricants and the national need should instal these wherever possible.

A ball bearing will (dust excluded) run without lubricant at all, and present circumstances should make them more prominent than before. All grease and greasy material should be collected for treatment by refiners, and a large extension to ball bearing production should, to some extent, offset a peculiarly acute shortage.

UTILIZING SAW-MILL WASTES

Saw-mill waste amounts to about 40 per cent. of the original tree. The finished lumber, on the average, represents only from 30 to 35 per cent. of the tree. New developments in the utilization of wood waste are being made continually, but it is false economy to handle waste unless the by-product industries can be carried on at a profit. Effective utilization calls for a variety of chemical and mechanical processes which must be adapted to the form, species and quantity of wood waste available at any point. Slabs, edgings and trimmings represent 15 to 17 per cent. of the tree. Among the more common use are fuel, laths, box shooks, small slack cooperage, small wooden articles, kraft and sulphite pulp, excelsior, wood flour, wood wool and producer gas. Sawdust accounts for another 11 per cent., and is used to some extent for fuel, producer gas, briquettes, polishing metals, insulating, packing, bedding in stables, floor sweeping compounds, composition flooring blocks, linoleum, improving clay soils, smoking meat and fish, blasting powders, wood flour, plastics, porous bricks, mixing with mortar and concrete, distillation, ethyl alcohol, oxalic acid and carborundum. Bark amounts to about 10 per cent. of the tree. It is usually used for fuel, although hemlock and oak barks are important in the tanning industry. A recent development is the use of spent hemlock bark for mixing to the extent of about 30 per cent. with rag stock in the manufacture of roofing felts. Experiments on its use in wall board, indurated pails, conduits and wall paper give promise of success. In the manufacture of special wood products a good deal of wood is lost, during seasoning, by decay, due to poor methods of storage, and also by warping and splitting. There is a large waste in converting wood into the desired shape for the finished article. Proper co-ordination with plants making small wooden articles brings about a great economy of material. Shavings find use as a fuel and to some extent for packing, bedding, drying wet land and manufacturing fibre board. Beechwood shavings are required in large quantity by vinegar factories, but this is another case where specially cut wood is usually used instead of relying on by-product wood from various plants.

Steel founding is no child's play, the daily crop of problems raised and difficulties to be overcome being considerably more than encountered in most manufacturing enterprises. Steelmaking to-day cannot be undertaken by men without technical training. Notwithstanding the many alluring prospects presented by those who are anxious to sell and install foolproof steelmaking processes, there are none which may be so classified and which do not require closest attention of a practical metallurgist in order to produce high grade castings.



WELDING AND CUTTING

Returned Soldiers Make Very Good Welders

Training School For Welders Has Achieved 100 Per Cent. Success in Fitting the Soldier to Take up Peace-time Work Once More

By W. F. SUTHERLAND, Associate Editor

MECHANICAL industries of all kinds usually offer an attractive field for the returned soldier who is perhaps incapable of taking up his former employment. Many machine shop operations are closed to the injured man through their requiring considerable manual labor. These, too, in many cases, offer no opportunities for advancement and little chance of acquiring much technical skill. Autogenous welding is free from these disadvantages and offers the means of combining highly interesting work with excellent pay. In co-operation with the Department for the Soldiers' Civil Re-Establishment, L'air Liquide Societies have conducted for some time past a school for the re-education of the returned soldier in all branches of oxy-acetylene welding. The school has been an unqualified success. All men who have received instruction have made good, and are at present in positions demanding skill of a high order.

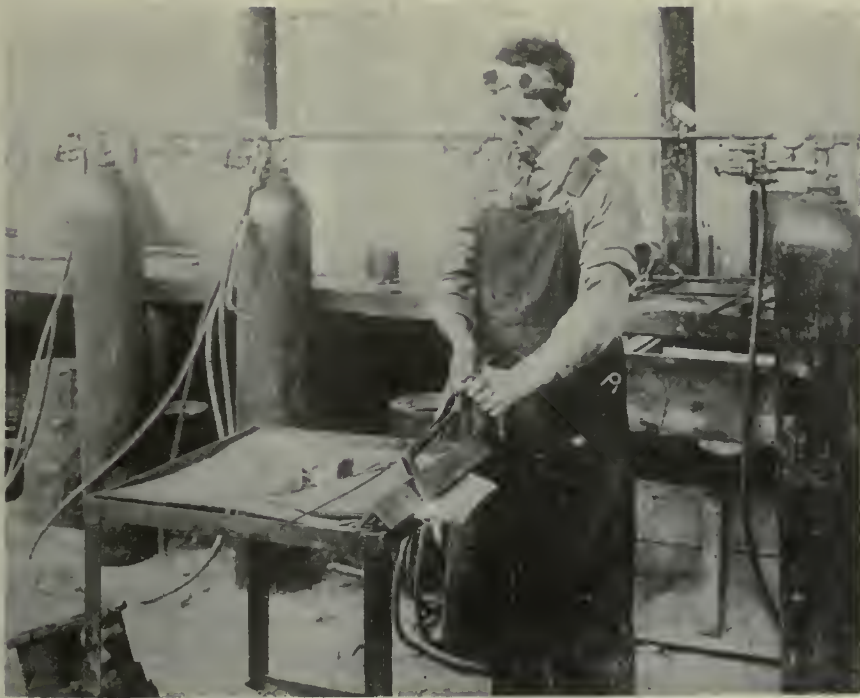
Although comparatively a recent development, the oxy-acetylene process of welding and cutting is a most important factor in modern industry, and its aid in promoting the enormous increase in the production of war materials and supplies incidental to the prosecution of the war can be scarcely overestimated.

Fifteen years ago the oxy-acetylene welding process was little more than a laboratory curiosity, but to-day it offers an exceedingly valuable opportunity for such returned men as wish to avail themselves of its advantages.

Duration of Course

After having undergone such medical treatment as might be necessary in the military hospitals, the soldier is given the option of choosing such instruction as he might desire to fit him for his life's work, guided, of course, by counsel and an appreciation of the disabilities which he may have. All courses are for a period of about six months or less, and are to a certain extent dependent upon

WELDING CAST-IRON AUTOMOBILE ENGINE CYLINDER—BUILDING UP BROKEN FLANGE



PRACTICING CUTTING ON STEEL PLATE

the skill and earnestness shown in acquiring knowledge.

On choosing the branch of re-educational work desired, the soldier is still under the direct jurisdiction of the department, being paid by them and his dependents cared for in like manner as was explained in a former issue.

vSraovkce4,aCjwofFCnoolatho ET ET

Instruction Given

The oxy-acetylene blow-pipe forms the first subject for instruction, its construction being gone into thoroughly, and an idea of the combustion of the gases used being given.

Correct welding practice is largely a matter of proper flame adjustment, the metal being either carbonized, correctly welded or oxidized as the flame is cargonizing, neutral or oxidizing in character. For this reason the characteristics of the different flames attainable receive careful attention, for to attain satisfactory results the pupil should be taught to distinguish the effect of correct and incorrect adjustments of the flame by its appearance and by the appearance of the molten metal.

The welding of steel is first taken up, the pupil being given instruction in the use of the cutting torch at the same time. Pieces of thin sheet steel are cut by the torch and then welded together. But joints are first welded, the more difficult lap being attempted as skill is attained. It might be thought that the welding of pieces of moderate thickness would be easier to start with, but it has been found that the welding of thinner work gives more scope for instruction and presents greater opportunities for the acquiring of skill.

Cast Iron Welding

After having done sufficient of the steel welding the pupil is put on cast iron work, as before scrap pieces being first employed for the acquiring of skill. As soon as advisable the repair of cast iron objects, deliberately broken, is attempted, automobile cylinders and other objects being cracked and then repaired. The building up of broken parts is done replacing parts broken off castings.

Almost every class of work is done, scrap material of every kind being used. This gives the pupil a wide field in which to gain experience. One example of work is to be seen in a flywheel with cracked arms and rim, the welds have been made, not by one man alone, but by a number, so well that little refinishing is required.

From the welding of cast iron the pupil goes on to the more difficult work of welding brass and aluminum, actual work being done on commercial articles.

The class of work being done by those who have received their instruction is well illustrated in the plant of L'Air Liquide Societe itself, the most complicated and difficult work being done by those who have received their instruction in the school.

Throughout the course the importance of pre-heating and allowance for expansion and contraction are not lost sight of.

Welding may be said to be an acquired art, and much depends upon the excellence of the instruction received and the sympathetic and interested attitude of those responsible. The school for instruction is carried on under the direct supervision of Mr. MacDougal. Altogether 20 to 30 men have received instruction as many as nine receiving instruction at one time.

ELECTRIC WELDING APPARATUS

Electric welding apparatus of extreme simplicity and of great adaptability has recently been developed by the Arcwell Corporation of Canada, 710 C.P.R. Bldg., Toronto. This apparatus, by its use of alternating current, does away with the motor-generator sets and other apparatus hitherto employed for this purpose, and by the accurate control and characteristics of the flame effects a remarkably successful joint.

The design of the apparatus resembles that of a transformer and is fitted with a number of taps, also electrode - cable with holder. Machines are built for any of the various commercial voltages and frequencies being stepped down through the medium of the transformer to the welding voltage of 20 volts. In operation the welder takes 3¼ to 4 K.W. energy, which is equivalent to about 5 h.p.

Taps are provided on the secondary or low voltage side for various amperes, and the flame produced is extremely hot and is all concentrated in the small arc. The character of the flame and the weld produced eliminate all trouble due to crystallization by heat of the metal being worked upon.

CHIPPING PLATE AFTER CUTTING FOR WELDING

The Mephisto arc welder has been used with excellent results on ship and boiler plate and steel castings of every description with no deterioration of the metal worked upon, and it has been demonstrated that the equipment has a wide range of ability to achieve results equal in character and quality of weld to that obtained by other systems, either electric or oxy-weld, at a very much lower cost, and in much less time.

The manufacturers draw attention to the fact that the arc is very stable and in consequence it does not by any means take an expert to handle it, any workman of average intelligence becoming accustomed to its use in a very short time. This fact, coupled with the much cheaper cost of electrical energy as compared to the other welding mediums, lowers production costs from six and eight dollars a day down to about one dollar per day.

ELECTRIC WELDING APPARATUS OF NEW DESIGN

An extremely favorable characteristic of the weld produced, is the ease by which it can be machined and finished, no difference between the weld and the body of the metal being apparent, and an ordinary file readily takes hold.

On account of the portability of the apparatus its usefulness is wide and it has already filled an important place in the shipyards, foundries, and machine shops of the United States.

While the standard equipment has a rating of 150-amperes, larger capacity machines are furnished, but where heavy work is to be done, the use of two or more 150-ampere units in multiple, is recommended, this arrangement having the additional advantage of flexibility.

The equipment is of very rugged construction, housed in a substantial wooden box, strongly braced, and is self-cooled throughout. Any type of metallic electrode, plain or coated, or carbon electrode can be used.

AN AUTOMATIC ENCLOSED GASOLINE ENGINE

By FRANK C. PERKINS

The automatic four cylinder enclosed gasoline engine noted in the accompanying illustration was developed at Bridgeport, Connecticut, U.S.A. This four cycle marine motor is said to have maximum economy of fuel and upkeep. It has a bed consisting of a substantial one-piece iron casting, the lower half being octagonal in shape, cast integral with base and with large oil reservoir located in center. There are flanges on either side for bolting to the frame work, and a square groove through center of base for crank shaft bearings. The sub-base is fully enclosed and securely bolted to the bed, on top of which are mounted the cylinders, magneto and governor assembly. In the side of the sub-base are hand holes for ready access to make adjustments on connecting rod and crank shaft bearings, while the cam shaft is also located in sub-base.

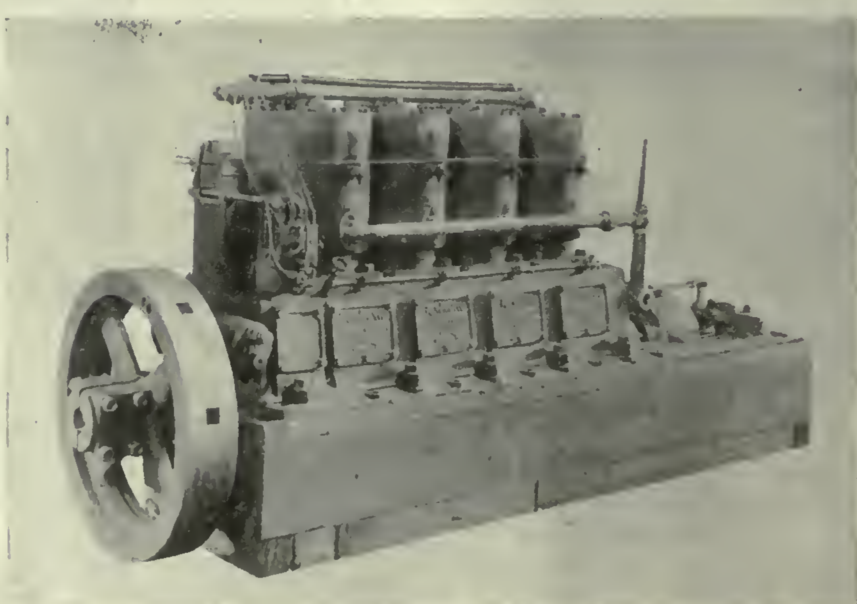
The square groove in the bed receives the crank shaft bearings and upper half of the gearing is reinforced by a steel plate onto which the cap adjusting screw rests. The bearing adjustment is made by turning an extra large octagonal head screw with keeper. This method permits adjustment without loosening the cap, which is thoroughly and permanently fastened in position. The keeper prevents this screw from working in either direction, and makes a quick and efficient adjustment.

The balance wheel is made with a split hub, bolted to crank shaft with four large bolts; also fastened with a large square key, insuring a perfect fit with no side motion or wobbling. Because of this split hub the balance wheel is easily taken off when necessary to do so. The crank shafts are hammered from solid blanks of high-carbon steel and one cam shaft only is used, of 40 carbon machinery steel and on the shaft are cams for operating inlet and exhaust valves. The solid bearings for this shaft are of cast iron with bronze bushing.

The cylinders are of L type, one-piece castings, having separate heads. The top face of cylinder is without cored holes, except one for circulating water, and this is outside, so that there is no possibility of water entering the cylinder. The cylinder heads are cast of the same iron as cylinders, with ample water space around valve hole covers. In coring the cylinder heads there is no opening whatever between the head and cylinder, except at the extension for water provided to meet extension in cylinder. The water circulation is of special interest. Extra large water space has been allowed in the cylinders, cylinder heads and around valve seats, the water being supplied by a plunger type of pump attached to the aft end of each engine and operated by an eccentric on the cam shaft.

The valves are of nickel steel, the end of the stem being threaded and provided with special clasping locknut for adjustment. The valves are so situated that they may be reground and seated without removing cylinder head. The valve head caps are of cast iron with air-cooled vanes to assist cooling spark plugs. The valve lifters are of the mushroom-head type, slightly off center of cams, and made of open-hearth steel, fitted into separate cast bushings and held securely to the sub-base. This type of lifter allows a great area of opening for a long time, which is most desirable.

The lubrication is provided by a large geared force pump, connected to the spacious reservoir in bed of motor. The question of oiling an engine thoroughly has been taken care of. The oil pump is located inside forward end of engine,



BACK VIEW.

Electrical Engineers Meet in Toronto

Interesting Canadian Developments in Electrical Engineering Described at Meeting Held Under the Auspices of the Toronto Section of the American Institute of Electrical Engineers

THE development of Canada's waterpowers, the features of design being developed for transmitting electric energy, and the electrification of her railways, formed the interesting subjects of papers read before the 344th meeting of the American Institute of Electrical Engineers, held in Toronto, Friday and Saturday, Nov. 22-23. This meeting has a special interest for the engineering profession of Toronto, in that it is the first meeting of the main society ever held here under the auspices of the local section.

Members were present from various points, New York, Philadelphia, Niagara Falls, Erie, Pittsfield, Pt. Huron, Schenectady, and other points including Austin, Texas.

The afternoon session, Friday, was opened by the chairman, Arthur H. Hull, who, in his address, welcomed the American delegates. F. L. Hutchison, the secretary of the A.I.E.E., in the absence of the president through war activities, responded. The Toronto section was one of the first local sections organized. The plan of establishing local sections was first brought forward in 1902, and this section was organized in 1903. It is one of the few that has kept up its activities during the war to anything approaching pre-war standards.

In a paper read by Arthur H. Hull on "Electric power generation in Ontario on systems of hydro-electric power commission," the progress to date of the municipally-owned system was outlined.

Ontario has developed into the greatest manufacturing province in Canada, and as there are no coal deposits its abundant waterpower resources are being more and more utilized to furnish the power required for its varied industrial developments. About 702,000 horsepower are developed in Ontario at present, leaving a total of 4,227,000 horsepower still available. Of the above total for power developed, about 69,000 horsepower is used in pulp and paper manufacture, about 59,000 horsepower is used as hydraulic power directly applied, and teh balance, 574,000 horsepower, is converted into electric energy for light and power. The commission now own and operate ten systems in the various parts of the province from Port Arthur to the Rideau and St. Lawrence, and as far north as Nipissing Village. The various systems were described in detail and data given on the new Queenston development now under way, as well as on the extensions now being carried on at the Ontario Power Company plant. In connection with this latter, the speaker stated that the two new generators of 15,000 kva. rating each, were made in Canada, with the exception of the steel laminations and insulation. This speaks well for Canadian industry under war conditions.

The second paper read on Friday afternoon by Mr. W. G. Gordon on the "Electrical equipment of the Canadian Northern Tunnel in Montreal." This work is one of the most important that has been undertaken in Canada of recent years, and the features of electrical design dealt with in the course of the paper were of unusual interest. Following a description of the tunnel proper and the terminal conditions which had to be dealt with, the author entered into a detailed description of the electrified portion of the track ten miles in length. It is later proposed to extend this electrification of the railway to Ottawa, and the substation feeding the system was located with this fact in mind. Power is obtained from the Montreal Light, Heat and Power Co. at 11,000 volts and 60 cycles, and by means of motor generator sets, is distributed to the railway feeders at 2,400 volts direct current. This voltage is the highest that has been used in Canada up to the present time for this work, and was chosen in view of the contemplated extension of the system.

Three types of traffic had to be considered in planning the equipment: passenger and freight trains and suburban traffic. The suburban traffic will be handled by multiple unit trains, each coach weighing 80 tons, and being patterned after the standard vestibule passenger coach. The passenger and freight traffic is handled by six locomotives; these locomotives are of the two four-wheel truck type, the two trucks being coupled together to the draft gear, leaving the body of the locomotive free from all stresses.

Pantograph collectors are used with overhead catenary suspension of the trolley wires.

Sir Robert Falconer

At the conclusion of the discussion on the above paper the members and delegates adjourned for dinner. Sir Robert Falconer spoke on the impressions he had gained on the occasion of his last visit to the western front a short time ago.

The bravery and fighting qualities of the Canadian Army Corps were never more in evidence than at the battle of Amiens, and later at Arras. Vimy Ridge was a glorious episode, and one in which the Canadians won lasting fame, but the two latter battles in the speaker's opinion were even more to their credit. Sir Robert had the good fortune to be present during the opening stages of the battle of Arras, and the sight of the Canadian reserve divisions pouring up to take their part in the struggle was one never to be forgotten; the columns of men, artillery and transport, moving on with clock-like regularity, and proving irresistible in battle to the foe.

The German troops opposite Arras got the surprise of their lives when they found the Canadians were the ones who were putting them to rout and bagging them as prisoners. It seems that these selfsame prisoners had been moved to the quiet Arras sector to rest up a bit after the terrific mauling they had received at Amiens a few days before at the hands of the Canadians.

One of the most important lessons the war could teach the people of the allied countries was the value of research and science in either war or peace. Organization was always one of Germany's strong points, and it was well known that the United States was her equal, but Great Britain was thought to be woefully backward in this particular. However, her organizing powers were not dead but merely quiescent.

Science, while adding horrors to the war as conducted by Germany, yet had achieved one of the miracles of the age in the success which had attended the efforts of the medical staff of the armies in the field. Preventive medicine and surgery had made greater strides in the last few years than ten years of peace would have brought about.

Engineering at the front was, in the last analysis, one of the material factors in the bringing of victory to the allied standard.

Long Span Transmission Lines

The evening session, held in the Chemistry and Mining Building, University of Toronto, was devoted to a paper read by Mr. S. Svenningson on the longest span river crossing yet erected. The paper dealt with some remarkable contruction work recently completed by the Shawinigan Water and Power Co. near Three Rivers, Que. The St. Lawrence River is crossed by transmission line wires on a span of 4,800 feet. Due to the necessity of maintaining navigation clearance, the towers are 350 feet high.

Four reinforced concrete cassions, 11 feet diameter for each tower, have been sunk to a depth of 45 feet and placed on the corners of a 60 ft. square. These piers are connected by heavily reinforced concrete beams 4 ft. wide by 8 ft. deep. There are two towers 350 ft. high, and 60 ft. square at the base, the upstream and downstream faces tapering to a width of 14 ft. at the top. The cross arm at the top is 14 ft. wide by 100 ft. long, and carries the three sheaves over which the main steel messenger cables pass to the anchor towers.

Three lines of cable 50 ft. apart span the river between the two towers. The cables are 1⅜ in. in diameter, and are made of galvanized plough steel. They are composed of six strands of 19 wires each and a stranded core of 30 wires. To each end of the center span cables is yoked two anchor span cables; these are carried over the tower on the 8 ft. diameter sheaves and then down to a point about 20 ft. from the anchors. At this point equalizing beams are cut in the lines, and the load is transmitted from this point to the anchor piers by means of short straps of 1¾ in. cable.

It was originally intended to use the main cables as conductors and to insulate them from the tower by specially-designed insulators. Unfortunately these insulators were not completed in time for erection and the main cables are now used as messengers carrying a No. 1/0 stranded copper conductor on suspension insulators.

Visit Local Plants

Saturday morning the delegates and local members visited the British Forgings, Leaside Munitions, and the Strachan Ave. terminal station of the Ontario Hydro Electric Power Commission and their laboratories on the same site. Canada's share in the supplying of munitions to the Allies and to the United States is due in no small measure to the enormous output of the British Forgings and Leaside Munitions plants, and the opportunity of visiting the world's largest electric steel plant was one which the majority of the delegates availed themselves.

Japanese Government Aids Engineering Industries

Is Keenly Alive to Possibility of Making Japan's Chemical and Steel Industries Self-supporting — Representatives Getting in Touch With Latest Developments in America and Europe

THE world-wide shortage of raw materials and the dislocation of trade consequent upon the war has been felt fully as much in Japan as elsewhere. The iron and steel industry and those manufactures depending upon chemical science for their existence have suffered most of all in Japan. To meet these conditions and to make the country self-supporting to a greater extent, the government is taking active steps to establish permanent industries in Japan, and in doing this is investigating recent progress in other countries.

Two government representatives have been in the United States for some time looking into the various phases of manufacturing as there carried on, and last week availed themselves of the opportunity of inspecting some of Canada's progress in the steel industry. Mr. Shin Nakahara, Mr. S. Sakai and Mr. Genjiro Jinguji, consulting engineer of New York, were in Toronto at the meeting of the American Institute of Electrical Engineers, held under the auspices of the Toronto section, and while here were very much interested in the operation of the British Forgings electric steel plant.

Mr. S. Sakai, chemical engineer for the Imperial Industrial Laboratory, Osaka, Japan, and Mr. Shin Nakahara, of the Imperial Steel works, Yawata-Shi, Japan, are both graduates of Japanese universities, while Mr. Genjiro Jenguji, who is representing them, and whose offices are at 15-21 Park Row, New York, is a graduate in engineering of the University of Illinois.

In conversation with a representative of CANADIAN MACHINERY, Mr. Shin Nakahara stated that the electric furnace in the steel industry was extremely interesting from the Japanese point of view, and offered opportunities for the production of high-grade and alloy steels of which they were going to avail themselves. The Imperial Steel Works have at present a 5-ton furnace and expect to increase their capacity in the near future. Questions of electrode and current consumption, life of furnace linings, control, and quality of steel produced were all of the greatest interest to him, and much interest was evident in the arrangement and operation of our National Electric steel plant. The scope of the work contemplated may be appreciated in his statement that he was desirous of getting in touch with makers of equipment for blast furnace, open hearth and bessemer plants and electric furnace plants, including all electric equipment. Rolling mill installations were also contemplated, and it was expected that plates, sections, and bar steel would be rolled.

The iron and steel industry offered excellent opportunities for expansion, and the vast potentialities of China as a source of raw material and as a market for finished wares would in time prove of immense value in establishing a permanent market.

Chemical Industries

Japanese textiles, needless to say, are noted the world over, and German dyes have for many years played an important part in their production. This trade has been probably lost to Germany for ever, if contemplated developments in Japan mature. Coal tar dyes, while important in themselves, are only a fraction of the immense number of substances produced through the medium of chemistry of the carbon compounds, and the development of the iron and steel industry necessitating vast quantities of coke, goes hand in hand with chemical enterprises.

Energetic means are being taken to make Japan's chemical industries self supporting. and the building up of her industrial life demands the entering into nearly every branch of it, so closely are they interconnected.

A few of the items which it is proposed to manufacture necessitate the purchase of equipment for the making of acids, dyes, caustic manufacture. and for electro-chemical industries. These latter include electric furnace equipment for iron and steel, carbide, cyanamide, and ferro-alloy manufacture, together with electrolytic equipment for theh refining of metals, plating, etc.

Laboratory supplies are also badly needed, optical goods, glassware, furnaces, and practically everything which is found in the usual industrial laboratory are badly needed.

Opportunities for the building up of an export trade in the lines indicated are very promising according to the statements made by the representatives, and in many lines the possibility of building up a permanent business in some of the lines is apparent. The manufactures required may be roughly grouped into two main divisions, chemical industries and the iron and steel industry.

The Japanese steel industry requires blast furnace plants, open hearth and bessemer plants, electric furnaces and equipment, and bar shape and plate mills.

Chemical laboratory supplies may be summarized as follows: Optical goods. pyrometers, microscopes, polarimeters, ultra microscopes, stereoscopes, etc.; chemical glassware and general laboratory apparatus; muffle furnaces, combustion trains for carbon determination, chemical balances and other general analytical and research apparatus.

In the field of industrial chemistry the possibilities for export trade are wide. The dye industry. acid and alkali works, carbide. cyanamide. and ferro-alloy are industries offering an opportunity as extensive as it is varied.

A NEW PLANER FOR SHIPBUILDING PLANTS

A new industry just established in Montreal is the manufacture of the simplex electric planer by the Simplex Floor Finishing Appliance Company. It is claimed that one of these planers does the work ordinarily done by twenty men in hand planing. It is used extensively in shipbuilding. Eight of them varying in length from 150 feet to 300 feet have been supplied to the Canadian Vickers Company. It is stated that these planers can be reset in a few minutes from planing rough timber to polishing deck surfaces or ways in shipyards.

Grinding; Its Utility in the Modern Shop

Grinding Has Become an Operation of Great Utility and Successfully Replaces the Lathe in Many Lines of Manufacture

By D. STREET

DESPITE the recent great extension of grinding as a machine shop operation erroneous ideas as to the sphere of action of the grinding machine and as to the principles and practice of the grinding processes are still prevalent. It is still widely believed that grinding is only necessary or advantageous when hardened work has to be dealt with, that it is essentially a slow process, that its scope does not extend much beyond the giving of a final polish to an already rough tooled surface, and that any way it is not of much use for general work, as distinct repetition manufacture. These ideas, among others, were effectively dealt with by Mr. H. H. Ashbridge in an excellent paper on "Workshop Precision Grinding," read before the Manchester Association of Engineers recently. At bottom they are founded on a belief that grinding is in essence a rubbing or polishing process. That, of course, is incorrect. Whether the materials to be ground are in hardened or soft state, or whether forged or cast, grinding is just as surely a cutting operation as using a lathe or planer tool. Just as the tool has one cutting edge, and will remove a chip proportional to its strength, so the grinding wheel has multiple cutting edges and the chips removed by each cutting edge bear a striking resemblance, when examined under microscope, to those produced by the lathe tool. It is not claimed for the grinding wheel that it can compete with the lathe or other machine tools as a metal removing machine, as measured by bulk of metal removed, but in any metal-removing operations that include finishing, a point is reached when the grinding machine in some form or other will remove metal faster than the cutting tool of the machine. No universal rule can be given for readily determining the point at which the advantage passes from tooling to grinding; it must be judged from each piece of work separately. Some typical examples are, however, on record. In the course of tests carried out by Mr. Dempster Smith at the Manchester School of Technology, it was found for example that the best attainable time for a finishing cut of 0.003 inches, with a lathe on an 8-inch shaft, was 7¼ minutes per foot, while a grinding machine would remove the same cut in 1½ minutes per foot. These times are for grinding and tooling to approximate size. For the whole work of removing the same cut, and also sizing to within .005 inch limits the grinding machine would require only four minutes; what the lathe would require over and above 7¼ minutes for sizing, filing, and polishing is not stated. Experience goes to show that the last thin skin of metal up to .015-in., .02-in. thick can be removed quicker in the grinding machine than any other method of machining, while if the amount of metal left on for machining is not very great, the grinder can do the whole job, roughing and finishing, very much quicker than the lathe. From an 8-in. shaft a cut of 1-32-in. can be removed by grinding at the rate of four or five minutes per foot length. Against the common belief that the grinding machine is one used for mixed work the grinding machine shows to advantage on repetition work, owing to its arrangement for accurate feed and automatic trip when the article being ground has been reduced to its predetermined size; these same features also make the machine advantageous on single articles, as after taking a few trial cuts, the work is measured for the amount oversize, and the micrometer feed set to take off the remainder, which can be done with great exactness. One important point rightly emphasized is that while the operator may by skill counteract the faults of a defective lathe, the grinding operator has no such recourse; hence grinding machines must be correctly designed well made and properly maintained. Moreover, the lathe operator can get moderately good results within wide range of speeds, feeds, and tool shapes, but in grinding the conditions of efficiency are much more narrowly circumscribed, and the operator must follow closely the directions, or the result will be not merely diminished efficiency but failure. The qualities essential to good grinding machines are truth and rigidity. The necessity for a high degree of truth will be seen from a moment's consideration of the fact that, while most machining operations are of a primary character, the ultimate finishing being done by other means, such as the file or a scraper, a grinding machine or a finishing machine, in which the work produced needs no further correction. For this reason, it follows that the sliding surfaces of the grinding machine should be as nearly as possible true planes, otherwise accuracy of product is impossible, and the object in view isolated. The limits of error allowed in building grinding machines are "none," but certainly the highest degree of accuracy is essential. Rigidity is no less important, and especially rigidity in the grinding wheel head, which must be heavy enough to carry the largest and the broadest wheel with which the machine may possibly be fitted, and also to overcome any possible want of balance in the wheel itself, while the spindles and its bearings should be of similarly ample proportions. It is for this reason that the grinding machine cannot very well be improvised. Many attempts have been made to convert the lathe into a grinding machine by means of attachments, but such attempts can only meet with very moderate results, owing to the lack of the necessary rigidity. Yet another essential quality in a grinding machine is ample driving power, in order that the whole may not slow down during momentary heavy cutting. Not only is the wheel wasted by being allowed to slow down, but what is more important, the wheel face is destroyed, and more frequent truing up is necessary. Many a potential user of the grinding machine has been put off by the thought of the number of fairly expensive grinding wheels of various widths and grades that must be kept on hand for the different kinds of work. For plain external grinding it is very unusual in general machine work to require more than two wheels to a machine, one to grind all classes of steel work with, and the other to deal with all cast metals. Closer grading can be done where the work is all of one class, but for general mixed work a couple of wheels can be arranged to efficiently cover the range. This has only been made possible by quite recent improvements in wheel manufacture. Perhaps the most striking item is concerned with wheel width and table travel. The two must be considered in conjunction. It is of very little use to have a wide wheel in combination with a slow table traverse. The only result of such a precedure would be a limitation of the production of the machine, and excessive wear on the portion of the wheel used, causing the machine to generate a round face, and making frequent truings necessary in order to cut away the unused portion of the wheel. The question is often raised whether the wheel keeps flat when grinding work with shoulders. If the traverse of the work per revolution is less than half the width of the wheel, then the cutting face of the latter will gradually wear convex, but if the traversemper revolution of the work is over half the width of the wheel, then the wheel will preserve a flat face. The ideal traverse per revolution of the work is about two-thirds the width of the wheel, but it should not, except for finishing, be less than half the width. It is for this reason that the grinding machines are now being built with table speeds of 16 feet per minute over, in combination with wide grinding wheels. The main factor governing production on external cylindrical machines is the combination of wide wheels with fast table speeds, as, other things being equal, the machine which possesses these advantages is the most efficient tool. Work speed is the least important of all the factors mentioned.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

HOME-MADE TOOLS FOR THE ELECTRICAL REPAIR MAN

BY MAURICE CLEMENT

It is surprising to note the large number of homemade tools one can see in an electrical repair shop; the fact that none of these tools can be bought ready-made, but must all be specially constructed, gives them an interest that is lacking in all standard tools; everything from a coil taping needle to an armature banding tension block, can be seen among an armature winder's tools.

For the benefit of those who are interested, I shall go into detail concerning these tools. The first, and most simple, is the "coil taping needle." This is made of a length of No. 14 banding wire, as shown in Fig. I. As only one foot of the wire is used in making the taping needle, it can be had at a very low cost; the taping needle is used for taping coils in closed slot stators, and when the user becomes accustomed to it, much speed can be attained, thereby saving considerable time.

The coil raiser, also in Fig. 1, is simply a piece of steel, 16 inches long, 1 inch wide, and 3-16 inch thick, with a 4-inch one-sided taper to it on one end. This tool is used mainly in stripping open slot armatures and stators, but can also be used to good advantage in removing grounded coils sufficiently to allow for insulating a weak spot in the coil, the main object being, in this case, to lift out a tight fitting coil without damaging the insulation.

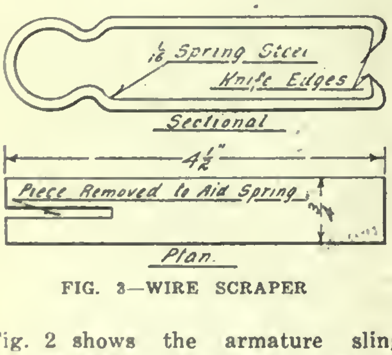


FIG. 3—WIRE SCRAPER

Fig. 2 shows the armature sling, which is made of a piece of 1-16 inch sheet iron, 2 feet long and 10 inches wide; at each end is a steel triangle, made of a ¾-inch steel bar, for hooking on to a crane. Without this sling, a rope or wire cable strap would be used, with the danger of springing the shaft; in a recent test this sling has held a

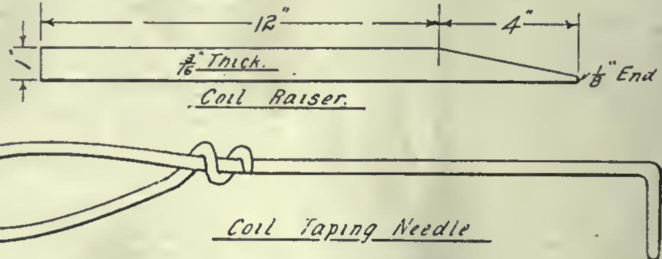


FIG. 1—COIL TAPING NEEDLE

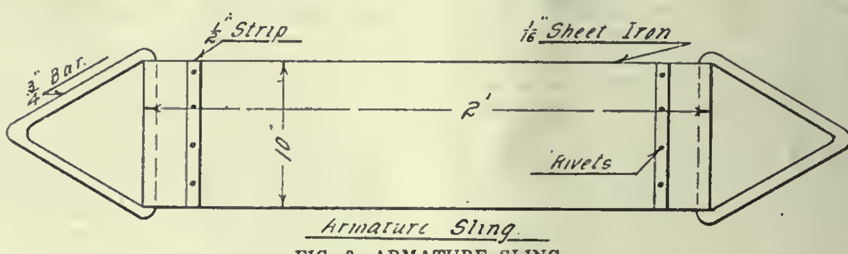


FIG. 2—ARMATURE SLING

weight of one ton, without apparent strain.

The wedge-drift is a piece of tool steel 8 inches long, ⅝ inch wide, and 3-32 inch thick; over which is fitted a loose fitting steel sleeve, 1-16 inch thick The wedge-drift is used for driving fibre wedges between top of coil and lamination overhang in closed slot machines; to use the wedge-drift most efficiently, the fibre wedge must first be inserted about a quarter-inch into the slot, then with the drift pulled back in the sleeve, fit the sleeve over the wedge and drive to the proper place; the sleeve holding the wedge in its position properly and preventing breakage.

The wire scraper, Fig. 3, is one of the best little time-savers of the whole lise. In ordinary circumstances a knife is used to scrape wires prior to connecting, but with the rough treatment a knife receives in scraping wires, its life is very short, necessitating frequent renewal of knives and incidentally, added

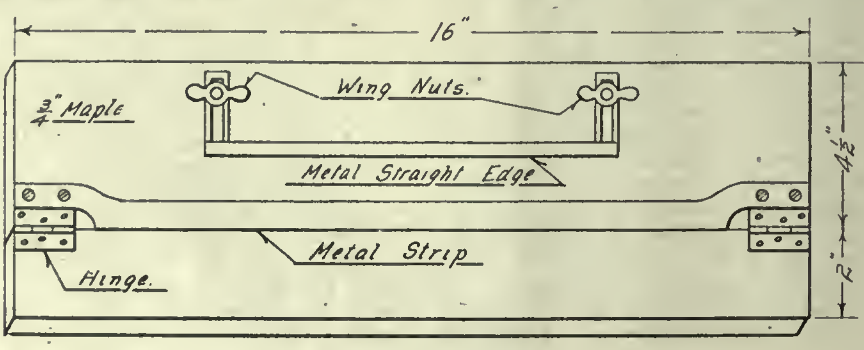


FIG. 4—CELL SHAPER

expense. The wire scraper is made of spring steel and is primarily 1 foot long and ¾ inch wide; before bending to the desired shape, grind a knife edge on each end and cut out a piece 2 inches by ¼ inch from the centre.

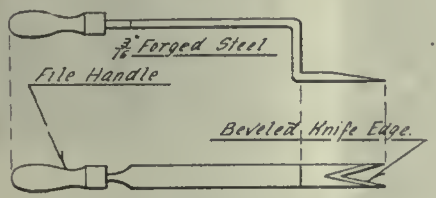


FIG. 5—CELL CUTTER.

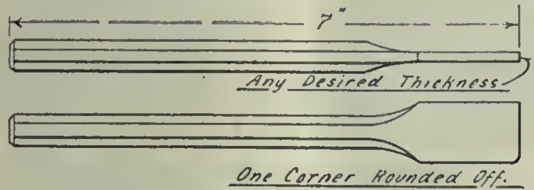


FIG. 6—DRIVING DOWN TOOL

After bending to proper shape, knife edges can be retouched with a file. The open space, which is now at back end of scraper, gives a greater spring effect and allows knife edges to be brought together with a minimum of pressure. In Fig. 4 we have the cell shaper, which, when we take into consideration the valuable work it does, is well nigh indispensable to any well regulated repair shop; the base of the cell shaper is of hard wood, in this sase being maple; it is composed of two pieces, one being 16 in. x 4½ x ¾ in., the other is 16 in., x 2 in. x ¾ in. These pieces are hinged together on the long edge.

Where the two pieces of wood meet, a half-inch metal strip is piaced. This strip is shaped at the ends so as not to interfere with the action of the hinges, and held down by screws; between the hinges the strip is raised sufficiently to allow the inserting of a reasonable thickness of fish-paper.

Behind the metal strip is an adjustable metal straight edge with wing nuts to hold it in place; to make a cell for a closed slot stator or armature, length of slot must first be determined, allowing for a short projection. Next, height of slot, measuring from bottom of slot to bottom of lamnation overhang; width of slot at the bottom must also be determined. This gives us the following:—

Length of slot + projection = one dimension.

Height of slot x 2 + width at bottom = other dimension.

In cutting the fish-paper for these cells, it must be remembered that there is a proper and improper way of doing it; the grain of the paper must be taken into consideration. The right way to cut it is to lay out the first dimension with the grain and the second across the grain. In adjusting the cell shaper, the distance from the forward edge of metal strip to the metal straight edge should be equal to the height of slot.

To shape cells, insert fish-paper under metal strip until it is squarely against straight edge and turn hinged base on hinges; this will make a neat fold in the paper; turn paper around and make another fold on opposite side, all is now ready to use.

In Fig. 5, the cell cutter is another very simple, but very effective tool. It is composed of a piece of forged steel, 14 inches long, ¾ inch wide and 3-16 inch thick, with a set of bevelled knife edges at one end and a file handle at the other; the handle is raised so as to allow free movement of the cutting end. It is used in cutting projecting insulation from slots of open slot windings after coils have been assembled.

In Fig. 6 we have the driving down tool, which is nothing more than a thin bladed chisel, with the end squared off. It is used for driving down leads into commutator slots. It is advisable to have four or five chisels with various blade thicknesses, to provide for different sizes of wire. The armature banding tension block, shown in Fig. 7, is a device which does away entirely with the necessity of a banding lathe; in the small shop, where the armature winder does his own banding, the tension block is an innovation worthy of notice; the armature does not have to be removed from the stand to be banded.

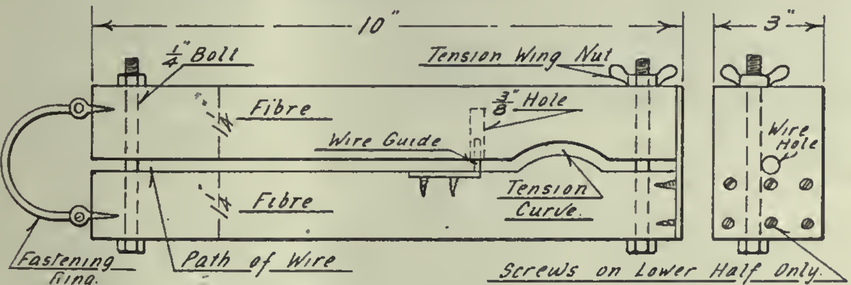


FIG. 7—ARMATURE BANDING TENSION BLOCK

About one foot of stout line with a hook lashed to one bed is made fast to the fastening ring on the tension block and hooked to an eye bolt, which is set in the floor for that purpose. The spool of banding wire is placed on a small stand beside the eyebolt; the wire passed between the two blocks at the rear end, through hole in first wire guide over tension curve, and through second wire guide hole, thence to the armature.

The tension can be regulated by the wing nut at the forward upper end of the block; by screwing down the wing nut, both sides of the block are brought nearer together, thereby narrowing the tension curve over which the wire must pass, this increases the resistance on the wire and incidentally the tightness of the band; a pipe wrench is used on the shaft to revolve the armature. It will be noticed that the forward end plate is screwed down to the lower half only, so as not to interfere with the tension wing nut and bolt.

CUTTING THREADS

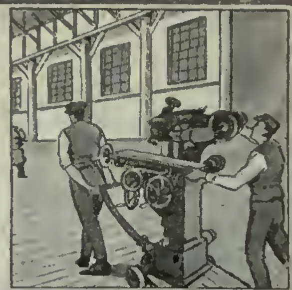
By J. J. DIXON

When cutting thread in a lathe or when getting internal diameters, etc., it is frequently the practice in making internal threads for the draughtsman to give just the number of threads to be cut, not giving the diameter of the top of the thread in internal work. The workman, for example, is given a spindle to turn 3 in. diameter and a thread to be cut on it 12 threads to the inch. Then he is given a nut to make, 3 in. diameter, 12 threads to the inch, to fit to the spindle. I have often seen lathe hands waste a lot of time getting the diameter of the bottom of the thread on the spindle to enable them to bore out the nut the right size for hreading. This can nearly always be avoided by referring to the standard tapping sizes given for ordinary vee threads or sellers threads, as it does not make any difference whatever the diameter the thread is for if the number of threads per inch is given the depth of thread will be the same on any diameter. For example, ⅝ tapping is 11 threads per inch—drill to be used correct for root of thread is .507, subtract .507 from .625 gives .118, which will be the correct amount to leave in bore for threading any diameter having to be cut 11 threads per inch.

Practically all crucible steel castings and also converter steel castings containing over 0.4 per cent. carbon are annealed. Converter steel castings having less than 0.4 per cent. carbon may or may not be annealed according to the service which they are designed for. Coke-fired annealing stoves are customarily used in Australia. The castings are packed in the furnace and the side walls bricked up, or a removable top made in sections placed on the furnace. In only two of the foundries have pyrometers been installed to assist in governing the stove temperatures. So long as annealing ovens continue to be operated by guesswork, it is little wonder that castings fail to meet the standard specifications and the cause of failure has been a mystery.

Putting off an easy thing makes it hard, and putting off a hard thing makes it impossible.

DEVELOPMENTS IN SHOP EQUIPMENT



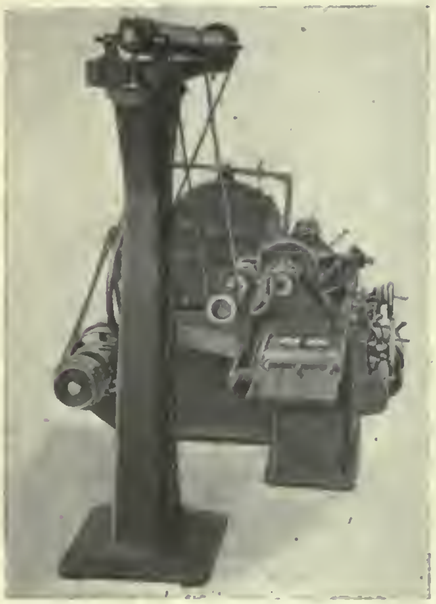
Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

STERLING CYLINDRICAL GRINDER

TO fill the demand for cylindrical grinding machines of high accuracy and capable of rapid production the McDonough Manufacturing Co., Eau Claire, Wis., have developed a line of grinders, built in various sizes.

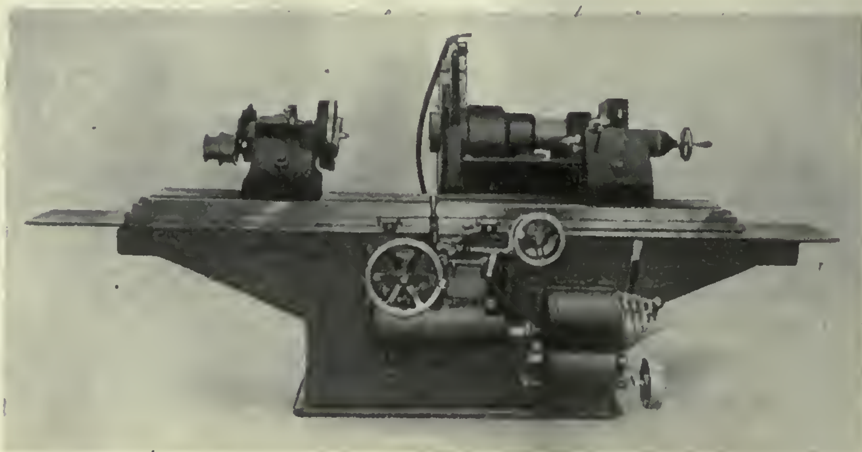
The frame is designed with a three point support which enables accurate work to be performed on all classes of production. All adjustments and speed changes can be made by the operator from his position in front of the machine regardless of the length of work being ground.

The grinder is self-contained, the counter shaft being carried on brackets bolted to the main frame. This arrangement cuts down the floor space required and always preserves the alignment of the counter shaft with the rest of the machine. This construction also permits the use of a shorter belt and eliminates the vibration sometimes caused by a long belt.



END VIEW OF CYLINDRICAL GRINDER, SHOWING WORK DRUM SUPPORT.

The grinder is adapted to all kinds of cylindrical grinding. It will swing work 18 inches in diameter, and the wide swing allowed also provides ample space for steady rests which will support work from one inch to 16 inches diameter and up to 56, 66 or 78 inches in length, depending upon the size of the machine. In addition to cylindrical work, sterling grinders are equipped for cam or crankshaft grinding.



STERLING CYLINDRICAL GRINDER.

The platen is fitted in extra large V and flat slides, which give a wide bearing surface. Automatic oilers insure constant lubrication of the slides. No gibs are used, the table and wheel frame resting on the slides by their own weight alone. The platen is accurately scraped by hand to insure perfect alignment.

The table is fitted to swivel on the platen for taper work. The end of the table is graduated to a one and one half inch angle, with the center line. The machine will therefore grind a taper of an included angle of 3 inches per foot.

The headstock and tailstock have extra large bearings on the platen which ensure rigidity.

The main wheel bearing is massive, accurately ground and runs in closely fitted S K F ball bearings. End play is prevented and thrust taken care of by the use of these bearings. A heavy wheel slide is carried on long, extra wide ways, the weight of the slide holding it firmly in place, and permitting an ease in movement that does away with sticking or sudden jumping into the work.

The work drive is by a drum counter shaft to a radially swinging pulley, which is carried on a quadrant. A conveniently located lever swings the pulley to tighten or loosen the belt. The work drive drum is carried on pedestal set behind the machine and is driven from the main counter-shaft through cone pulleys which permits varied speeds of work. The stand construction for the work drum is an improved method which eliminates heavy overhead apparatus. The stand is of box frame construction.

The cross feed can be actuated by hand or power as desired. The power feed is in the form of a rachet operated by the reverse lever with a variable stroke. An automatic stop is fitted adjacent to the ratchet wheel, thus permitting the stopping of the cross feed at any given point.

The water is supplied from a 16 gallon tank by a standard 1-in. centrifugal pump located at the end of the machine and driven by the counter-shaft.

ELECTRICAL INDUSTRIAL TRUCKS

The lack of labor and the increased wages of to-day would seem to warrant the installation of labor-saving appliances wherever possible in every manufacturing plant, warehouse, railroad, and marine terminal, or wherever ma-

ELECTRIC TRUCKS AS USED FOR 1—HAULING CEMENT FOR CONTRACTORS USE; 2—HAULING OXYGEN CYLINDERS; 3—AS USED IN THE FOUNDRY; 4—FOR HANDLING SEWER PIPE.

terial is to be moved in quantities. One of the main advantages of the truck system is that its route is not limited to a fixed portion of a plant or terminal as is the case with overhead chains or other types of carriers. The trucks illustrated herewith are manufactured by the Crescent Truck Company, Elizabeth, N.J. These trucks steer on all four wheels, giving the shortest possible turning radius, enabling the truck to operate in narrow intersecting aisles and runways. Timken worm and worm wheel transmission is used. S K F self-aligning ball bearings and Timken roller bearings are used in the wheels. The hinged platform, when raised, gives immediate access to the entire driving unit and battery.

The transmission is completely enclosed in an oil type housing and runs in a bath of oil; no parts are exposed to pick up dirt and loose materials from the runaway. Battery capacity is unusually large, the truck being able to run without re-charging at a speed from 5 to 7 miles an hour, with a full working load for a ten-hour day.

The frame is made up of four-inch channel steel, thoroughly braced with large gusset plates, and the cross members all riveted together with one-half inch rivets. The truck wheels are driven through a worm differential, giving positive traction. As the whole driving mechanism is enclosed in a housing and continually runs in oil, it is thoroughly protected from dust and dirt.

The wheels are of cast steel, mounted on tapered roller bearings and well provided for lubrication. The tires are of solid rubber, 25 inches in diameter, with 3 and one-half inch face.

The brake is of the internal expanding type lined with asbestos fabric, which is set at all times and has to be released by the operator's foot. A cut-out switch is so arranged as to automatically break the connection when the driver steps off the platform.

The truck is steered by a lever operating vertically, and is directly connected to all four wheels; this steering on all four wheels gives a turning radius of six feet, and allows the truck to enter the side door of a standard box car and run towards either end. All knuckles and joints are provided with lubricating devices.

The controller is of the drum type, three speeds forward and three reverse, with a positive stop between. The type of battery is optional with the purchaser, being either of the Exide lead type, or of the Edison iron and nickel type. It is of sufficient capacity to operate the truck for a full day's work, or ten hours without recharging.

A typical charge used for crucible steel is as follows: Pig iron, 20 pounds; scrap cast and runners, 40 pounds; scrap mild steel, 100 pounds. The composition of the steel produced by the crucible method depends largely upon the average composition of the charge. The metal, however, absorbs carbon from the crucible and the carbon content of the steel always increases from 0.2 to 0.6 per cent. during the melting.

Dominion Foundries and Steel Review War Work

Enormous Amount of Material Has Been Successfully Handled at the Plant in Hamilton—Appreciation of the Work Done by Sir Joseph Flavelle in Munitions Board at Ottawa

THE Dominion Foundries & Steel, Ltd., Hamilton, has issued the following statement in regard to their war operations:

This company has developed a capacity of 10,000 tons steel per month during the war, and in making this large increase in our capacities for shell work we continually had in mind the conversion of this product into commercial uses after war. A study of the imports of rolled steel into Canada shows in round figures about one million tons per year imported during the years of 1912, 1913, and 1914. This tonnage of steel imported is practically the same as increase in open hearth capacity of all the steel makers in Canada during the war, and the necessary finishing mills for finishing a very large proportion of this open hearth capacity into the shapes required can be built for a roughly estimated expenditure of $30,000,000, which amount is half the value of steel imported during each year for the three years mentioned.

Supervision Needed

The steel business of this country is in need of supervision and direction just such as was had in the shell work, and if the Canadian government will constitute a similar body of men, giving them powers to act, it will result in a development of considerable more industrial and financial value to Canada than the shell work. It will, of course, be done on a different basis of value and margins, but it can be made none the less effective.

We urge the Canadian government to foster and direct her steel industry. Just as sure as this is done Canada will grow in an industrial way.

In December, 1914, we were invited by the Shell Committee to consider the machining of British 18 pdr. shrapnel shell, and, as a consequence, an order for 50,000 of these was taken. Various means and methods of manufacture were studied, equipment purchased, and work commenced early in the year. The first shipment was made in April, 1915, and the manufacture of shrapnel shell was continued without interruption until September, 1917. In 1916 we erected a shop for the machining of 4.5 in. high-explosive shell, but later we discontinued machining and directed our efforts to steel making and forging. Our original order called for only 60,000 4.5 blanks at the rate of 10,000 per month. The first shipment against this order was made during the month of April, 1915, and the order was completed in June, 1915, or in less than half the time specified. By that time additional orders had been placed not only for the 4.5 in. blanks, but for 60 pdr. blanks as well. We continued manufacturing this size until the need was less urgent, when it was pointed out to the Shell Committee that the small sized blanks could best be made from rolled steel, and we discontinued the casting of small-sized blanks and changed over to heavier sizes.

In January, 1916, we undertook to produce 9.2 shell forgings as well as 9.2 in. cast blanks, and were successful in turning out the first 9.2 shell forgings made in Canada. We continued on this work intermittently until the end of the war, and we claim the production record of 39,673 forgings per month. Our best 24-hour run was 1,848 from a single press.

A Forging Record

In the Fall of 1916 we were requested to undertake the manufacture of 6 in. shell forgings, and built a shop and installed furnaces, presses, pumps, accumulators, etc., in record time, and turned out our first 6 in. shell forging the day before Christmas, 1916. This shop operated on 6 in. shell forgings until the war closed, and we have attained a production of 5,280 from two presses in one 24-hour run, our average being about 4.600 per day. We worked with the idea that furnace capacity was the most vital necessity, and with this in mind we installed sufficient furnaces to keep a constant stream of hot metal moving to and from the presses. We found in this way that four presses in operation, with six pumps and two accumulators, we could forge 800 tons of steel per day, which is also a record.

This company manufactured 216,775 tons of steel for shell blanks and forgings, and we forged an additional 30,000 tons of steel furnished by other makers.

Our production process was unique in that it developed the idea of the most direct conversion of shell scrap to shell forgings without pig iron. When pig iron was not available we carbonized with charcoal in our acid open hearths.

After-War Trade

All of our buildings have been erected not only for the manufacture of munitions, but with a view to utilizing them for our after-the-war activities. Each building as it was erected was carefully considered with this in view, and designed in such a manner that it can be changed over with minimum expense for peace production.

Open Hearth Furnaces

At the beginning of 1915 we had two 20-ton acid open hearth furnaces capable of melting 140 tons per day. This original furnace equipment was added to from time to time, until we now have nine 20-ton acid open hearth furnaces, two 35-ton basic open hearth furnaces, and two 6-ton electric furnaces, with melting capacity of 750 tons daily.

Electric Cranes

In 1915 we had 7 electric travelling cranes from 7½ ton 25 tons capacity. We now have 31 electric travelling cranes from 3 to 40 tons capacity.

Rolling Mill

In 1916 a 22 in. rolling mill was purchased and installation was completed early in 1917. This, with the necessary furnace capacity is capable of rolling up to 5,000 tons per month of billets and structural shapes.

Forging Press

At the same time the rolling mill was purchased a 1,000-ton steam hydraulic press was bought and installed in 1917. Later a 250-ton steam press and a 1,500-pound steam hammer were added to this department, and it is now capable of turning out 500 tons per month of forged billets and large forgings for marine engines, ships, locomotives, etc. Two large rough-turning lathes were recently added to this equipment.

The Plate Mill

Early in the summer of 1917 a 26 in. plate mill was purchased with the idea of rolling and shearing agricultural shapes such as plow shares, harrow discs, etc. This was installed and commenced operations in October, 1917, and is capable of producing 1,000 to 1,200 tons per month of harrow discs, plate steel and agricultural shapes. We intend to enlarge our steel plate making capacity and cover a much broader field to the extent of manufacturing 6,000 to 8,000 tons per month.

Financial

This industry made a net saving to Canada of approximately $24,000,000, this figure being the difference between our total sales and imports.

Our pay rolls were approximately $6,000,000 per year, and the resultant pay rolls incident to material purchased and the finishing of our product must represent a very large item.

This war has taught Canada the value of industry, and we again urge the government to direct the efforts of all Canadian steel makers in converting their war output into commercial shapes, and in this manner avoid a clash and ruinous competition. We can decrease costs in one manner only, and that is by specializing, which would follow the proper direction of the efforts of all steel makers in Canada.

What is to be the longest bridge in the world is to be built across the bay between San Francisco and Oakland, Cal. It will be five and one-half miles long and cost $22,000,000.

Has Shell Shop Training Been of Any Use

The Farmer Will be Better Able to Fix His Binder—The Bookkeeper Will be a Handier Man Around the House, But There Are Limits to All This

By ANDREW GLEN, Manager John T. Hepburn, Ltd.

CANADIAN MACHINERY asked several officials and mechanics of representative plants concerning the future of the shell-shop worker. The idea was to find out from these men if the training that had been received in shell work would be of any real benefit to the person at the conclusion of the war when other lines would be manufactured. The following opinion by Andrew Glen, manager of the John T. Hepburn Co., is well worthy of consideration. It goes thoroughly into the case in an impartial and unbiased way, and gives the result of several years of actual observation by a man well qualified to draw conclusions and express opinions.

"PEACE hath her victories no less renowned than war." To guide Canada's army of war workers safely through the dangerous period ahead demands skillful generalship on the part of the government; faithful, unselfish service from our captains of industry; steadiness and discipline from the rank and file and the complete co-operation of all, if victory in the field is not to be robbed of its counterpart at home. Already innumerable committees and councils are working on the plans of campaign for reconstruction. There will be manoeuvring of forces, entrenching, deploying, pioneering, training, scouting nropaganda, but when all is said and done, many individuals will have to settle the problem for themselves. Take for instance, the men who have been on shell operations for the last two or three years. The question is often asked, "What is to be their future?" "Has their work on munitions fitted them for something else along that line?" "Will there be room or welcome for them in the trades to which they would naturally turn?" Well, in the first place, who and what are these munitioneers? A heterogeneous collection certainly, a gold-rush crowd with all kinds and classes represented. Doctors and dagoes, bookkeepers and butchers, furnace men and farmers, teamsters and teachers. Those who had good berths will get back to their ships before they sail away. Many of the others may feel they would like to stay among machinery. Perhaps they like the whirr of it or the feel of it, but anyway, with all its noise and greasiness it may appeal to them more than their previous low-paid pick and shovel work.

ANDREW GLEN

What have they learned? The "management" likes to make its men specialists and unless these men have been moving rather freely around the different plants the chances are that they have been confined to one or two operations and have handled only a few machines. Most of these machines also have been designed for simplicity of operation and can be mastered in a short time. No mechanical ingenuity is necessary to turn out the shells and if the machine "goes on the bum" as they say, there is an S.O.S. call for the repair man. A trifling matter perhaps, but few turn in to investigate for themselves, and they are never expected to do any fitting or setting up. On the other hand, they have made a slight acquaintance with things mechanical; they have been in among belts and pulleys and metal-cutting machinery and are no longer scared of it; they have handled a few tools and have a rude working knowledge of the machinist's kit; they have used gauges and learned the knack of being accurate. How much they have learned really depends upon the individual. One man took to the work like a duck to water and could handle any operation with ease. Another never got over his awkwardness and was responsible for many breakages and much scrap.

So that in the final disposition of these men it is safe to assert that many will never be qualified to enter a machine shop and take their places beside those doing varied machine work or bench work. A few, however, will be acceptable as specialists and in the event of regular machinists becoming scarce in a year or so, may be admitted to full qualification. There is not much likelihood at present, however, that specialists will be required. Machinists will expect to be provided for first, and rightly so. They have the training and it would be inefficient, to say the least, to have them idle while teaching others.

Wherever those munition workers go, even if they return to their former occupations, the experience gained during their war work will undoubtedly not be lost. The farmer will be better able to fix his binder or his gasoline engine, the bookkeeper will be a handier man around the house and the teamster may aspire to driving a truck.

OUR idea of explicit confidence is the youngster writing letters to Santa Claus or the wife who believes everything her husband tells her.

DON'T fool yourself. Your job's pretty much like your pocket. You'll get out of it just about as much as you put in. If you don't put much into it you're pretty sure to pull about that much out.

SOME folks are inclined to throw up their fists and say, "Good land, what will we do when all the soldiers get back home?" Well, we were getting three meals a day before they ever went away. Some people are grouching so much about the soldiers coming back that one might suspect they were wishing the war might continue indefinitely.

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The Land's the Big Chance

THE world is hungry. It's so hungry that it's not going to have enough and to spare for some years to come.

What does that mean to Canada? Everything. Although this country is an industrial one to some extent, we can't get away from the fact that the land is our big chance.

Canada has never had enough farmers. Farming is our one and only way of producing new wealth. If a man puts a bushel of potatoes in the ground and digs out a dozen bushels, he has put into the world's market new wealth to the extent of eleven bushels of potatoes.

Western Canada is essentially agricultural. The trouble with that country has been that it was, in its good years, jammed to the neck with loafers. There were too many people making money without putting the equivalent back into the market in return. They were, in fact, camping on the necks of the people who were performing some useful work.

The people of Canada have their chance right now to do a service to the world, and in so doing solve their own national problem by turning the trend of population to the land.

In the mad rush for export trade, for manufacturing outlets, let us keep a sane censorship over our activities and see to it that we specialize first in the great industries that will build for us a real foundation.

Canadian manufacturers are just as much interested as any class in seeing that Canada shall build up and maintain a strong and prosperous agricultural community. If this is not done, then all else will simply be built on a false understanding and a deceptive basis that will have no more stability than a house of cards.

Facing the Loss

FIRMS that have made money during the war time now have a chance to show if they are made of the same good stuff as the men who went overseas.

One Toronto machine tool dealer who, at the close of the war finds himself stuck with a large stock of munitions supplies and tools that are worth only their scrap weight, put the case correctly when he said:—

"We are going to lose some money on this stock, and the only thing to do is to face the thing right now, accept the share of reconstruction that falls to us, and get rid of the last traces of war in our business. Let us take the war years and the loss we face now. Add the gains, subtract the losses, and we're still ahead of the game."

The trouble is that a good many Canadians were never near enough the battle line to get a whiff of smoke. Their property was never damaged, nor their chattels confiscated. They apparently do not realize how extreme was the situation for the Allies right up to the 18th of July of the present year. They don't want to take time to think seriously of the fact that this country hung in the balance between being handed as plunder to Germany and being allowed to pursue its course and take its place among the free nations of the world.

The stay-at-home section of Canada has its chance now to show that it is worthy of the sacrifice that has been made for it in Flanders and in France.

It can shoulder its share of any loss that is going to result from the cessation of war work, and see to it that that part is well cleaned up before the armies return from overseas.

See to it that we get back to normal as quickly as possible, and do it gladly, and not with a whine or a whimper.

A HAMILTON gentleman called at this office a couple of days ago. Discussing the money that some people had made out of the war, he thumped the pine table with his horny fist and said, "They have passed from pinching poverty to plutocratic prosperity." Shakespeare's double superlative, "the most unkindest thrust of all," hasn't much of an edge on that.

PUNCH, OR THE LONDON CHARIVARI.—August 14, 1918.

VON POT AND VON KETTLE.

GERMAN GENERAL. "WHY THE DEVIL DON'T YOU STOP THESE AMERICANS COMING ACROSS? THAT'S YOUR JOB."

GERMAN ADMIRAL. "AND WHY THE DEVIL DON'T YOU STOP 'EM WHEN THEY *ARE* ACROSS? THAT'S YOURS."

CONSTANT STUDY IS PRICE OF ALL PROGRESS

H. T. Manes is New Foreman of the Massey-Harris, Toronto, Tool Room

By A. J. TALLMAN

I LEFT H. T. Manes and hurried to overtake one of his men. We boarded the same car.

"What do you think of Manes?" I asked.

"Manes?" the man repeated; then, comprehension dawning: "Tracey you mean? Why, we'd do anything in the world for Tracey."

"Is that his first name?" I questioned.

"I don't know," the man said. "It is the name we call him."

H. T. Manes and his son of the 10th Battery, 3rd Brigade Artillery, C.E.F., France.

And then he talked about work in the Massey-Harris Company's Toronto plant and about H. T. Manes, who is foreman of the tool room; and I recalled how Manes had told me that he was quite alone in the world from the age of nine.

Indeed, it is possible that my travelling informant found me inattentive, for I was picturing the man Manes as a lad deprived of home influence, counsel and encouragement. I was feeling the hardships and lonesomeness that he must have known, and I was thinking that it was in a sense wonderful that he with his fifty years should not look a day older than forty.

Tracey Manes was a young man of twenty before he went into the tool room of the Massey plant. The last year of his apprenticeship he was four years older and making a dollar a day.

About a year later he went with John Perkins & Son, who at this time had a plant on Front Street East, Toronto. He was here only four months when the fates that concoct disease germs knocked the chip off his shoulder.

"It was Christmas before I was able to be around again." he told me. "I went back to Massey's, where John Orr was foreman of the tool room. The tool room comprised two lathes, one shaper and one milling machine.

"Then, in 1906, I went with the Canadian Fairbanks-Morse Company. Here it first came home to me that a man can either lag at his machine or really produce and that upon the choice he makes depends his future. The output of the lathe I operated doubled. Did I work harder or longer? Neither. I simply kept my mind on the job and worked as fast as I could.

"Lagging is the result of indifference or inattention. It grows into a habit. It is one of the habits I try to keep our apprentices from contracting. Don't think that I crowd them with work. They're free to stand around for minutes at a stretch, to look about them and see how other work is done, for that may do them some good. But when they're on work that they know perfectly, I want it done as fast as they can do it—and for their good.

"But to come back: I was just ten months in the Fairbanks-Morse shop when strike talk started. The manager knew what I thought about it. He came to me the day before the strike was called.

"'What do you purpose doing, Manes?' he asked.

"Leaving," I told him.

Manes worked for the Canada Foundry Company four months; for the Elliot Paper Box Company three years. He was with this latter firm when its plant at 333 Richmond Street was burned. He built the first, and probably the largest paper-corrugating machine used in Canada.

In 1911 he returned to the Massey plant which had become the Massey-Harris, starting on lathe work. A year later he was made assistant foreman, and in 1915, foreman of the tool room.

No; he didn't do it by experience alone. He read technical papers and technical books. He educated himself. The library and desk in his home aren't there for show.

"Tracey" his men call him, but in the Harbord Street Tech. he is Mr. Manes. And the young men and boys who attend on the nights that he is instructor have for teacher a man who thoroughly knows his subject, and a man who has taken the buffets of life with a smile.

Speakin' of Meals

WHEN folks go in to get a meal at some big, smooth hotel, you'd think that half the eatin' there was done by lookin' swell. You prance upon a carpet floor and when you take a seat, 'bout sixteen waiters swoop around to hand you out a treat.

Why one galoot he gets a pail and pours you out a drink, another whisks a battin' card, 'twould make you gasp and blink—another gets a napkin out and ties it round your neck, you'd think you'd get your puddin' and yer soup served by the peck.

They put six knives a-side your plate, likewise six forks and spoons, they start the band a-tootin' at forty kinds of toons.

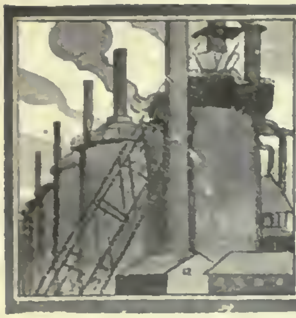
Old ham and egg, she's 80 cents, consomme 50 more, you clutch your seat to make her sure you're settin' on the floor.

By heck, there's silver dishes, there's folks a-bobbin' round, there's elegance jammed to the roof a-startin' from the ground. You're most a-scared to dig right in and stoke it as of yore, for fear you'll send the trappin's a-flyin' on the floor.

Ah, give to me the old-time meal, with just one set of tools, and cart away them boiled front doods and all the other fools. And let me saucer out my tea and eat pie with my knife, and do them other grand old tricks, they are the salt of life.

And let me have a kitchen fork to pick my hollow teeth, don't tempt me with the trinkets for fear I come to grief—them good old meals in good old ways is pleasin' night and noon, more so than sixteen waiters a-prancin' round the room.—ARK.

IS the government or the Food Controller afraid to tell the farmers that they must not chase the price of eggs up to a dollar a dozen? The squeeze is felt in the cities while the farmers run wild.



MARKET DEVELOPMENTS

Still Producing on American Shell Contracts

Although Shipments Are Not Being Made From Plants to Coast Points, Machine Tool Dealers Find That They Have Some War Stock on Hand Yet Which is Only Good For Scrap

PLANTS in Canada handling American munitions orders are still operating as though there was still a war on. It is one of the anachronisms of the situation that shells are still being machined at the same terrific speed that marked the days of the war's greatest mechanical production. This state of affairs cannot go on for any great length of time. In fact cancellations are anticipated in some cases very shortly. Contracts on which production was not commenced went first, and it is reasonable to expect that the others will soon follow. In United States cancellations and adjustments pending at present are estimated at some billion and a half dollars. Shipment is not being made to U.S. shipping points, but shells are now stored here in many cases. Some of the plants have ceased their Sunday work.

Those in close touch with the situation warn the public against paying too much attention to the first rush of peace orders that reach the mills as they cannot be accepted as a safe criterion of the trade that will follow. There are industries that have been starved for steel, and the accumulated orders of these concerns will make quite a showing for a time. In regard to prices it is unlikely that United States authorities will continue their effort for any length of time to stand behind the steel market. There is a decided tendency on the part of the big government purchasing commissions, the Railroad Administration and the Fleet Corporation, to buy in the lowest market, and if this is carried to any great extent it will mean that the steel industry will have to pass very quickly to a peace time competitive basis, and do so on its own merits.

Machine tool dealers and those who have handled war supplies find in some cases now that they are rather heavily stocked with machinery and stock that is worth little more than its weight in scrap. There have been several requests from shell shops to have dealers relieve them of this material, but it is unlikely that this will be done. There are some lines of supplies that are worth only one-sixteenth now of their value in the days of war production. There are no commercial lines to which they are adaptable.

Scrap dealers are passing through a period of stagnation of trade. There are no sales either way, in or out of the yards. Several Toronto dealers during the last week have sought Chicago or New York as an outlet for stocks held here, but they find conditions practically the same there.

Pig tin sales are made in New York at 71c, which is a drop of over 30 cents per pound in the last few weeks. While other prices have not actually moved to lower levels the prospects are that they will very shortly.

MONTREAL MARKETS REFLECT CONFIDENCE IN THE FUTURE

Special to CANADIAN MACHINERY

MONTREAL, Nov. 27.—The announcement that operations on the British shells would be discontinued in the very near future is now becoming evident and many plants are cleaning up on their last orders. In some instances plants here have been instructed to stop operations before the completion of their order. The general arrangement, however, is that the process of finishing will go on so that in most cases the work on British contracts will end before the close of the year. It is expected that operations on the American shell contracts will continue for some time but this appears to be very uncertain, although no plant here has been advised to the contrary. General conditions reflect the unsettled state of business both here and in the States, and in all directions the policy adopted appears to be one of watchful waiting. The shipbuilding interests and the marine shops have already absorbed a number of the men that were working in shell plants, and it is expected that the New Year will see new enterprises established along the lines of domestic activity. The markets are all more or less unsettled and no definite move has been made for a readjustment, but in view of the magnitude of the operations it is likely that this will take some little time.

Priorities off but Trading Quiet

The steel situation here has assumed a condition that is rather difficult to define and few dealers will offer a prediction as to the early future, but think that an easier market should be the outcome. The week's developments have virtually resulted in an open market, as all priorities are now discontinued. This, however, has not resulted in a stampeding for steel, although more business is reported in domestic lines. The situation to-day involves problems that were non-existent a few weeks ago, when the end of the war was not in sight. A month ago, with an open market, many consumers would have jumped at the opportunity of getting steel supplies, whereas, at the present time, everyone is extremely cautious in the buying of material. It is the opinion of some dealers that the American Government will continue to maintain a controlling price on the sale of steel, particularly plates, as a sudden withdrawal of the fixed price might result in a runaway market. Starving conditions have been a feature of the automobile business for a long while and if the price on sheets was suddenly left to the discretion or prudence of the producers, it would likely be found that automobile demand would result in a much higher price than that now effective. It is believed here that the War Trade Board will be retained for a further period to assist in the re-establishment of normal conditions. Production of steel in this district, for British munition work, is now a thing of the past and in a short time the same will likely apply to

American business. Normal quotations are the order of the day but lower levels are looked for this coming week.

Little Activity in Metals

The waiting attitude is the dominating feature of the present situation, and while to some extent the market is an open one, conditions are such that little actual difference is apparent in the general operation. The fact that copper prices in the States are fixed to the first of the year acts as a steadying factor, which is naturally reflected in the trading here. It has been reported that the British Government has recently placed orders for about 20,000 tons for reconstruction purposes, and this has been of considerable influence in adding stability to an otherwise unsettled situation. The tin situation is one that apparently requires judicious handling to avoid a panicky aftermath. As stated by one of the dealers here, this metal coming from the far East is often three months in transit, so that the policy of the War Industries Board will likely be to have a gradual readjusting of this market to avoid conditions that might create serious chaos. It is thought, therefore, that the decline to lower price levels will not be such as to disorganize the market. The spelter situation is practically unchanged, demand is lighter and dealers are apparently awaiting developments. The same might be said of lead, production is not excessive and consumers are looking for lower prices. Antimony is a typical war metal and as such has felt the cessation of war work quite heavily; the poor demand has been followed by a decline of 3 cents, the price quoted being 12 cents per lb. Operation in aluminum are still under certain regulations and in consequence the market is very firm.

Complex Tool Situation

Activity in the machine tool industry has been more or less disturbed since the cessation of hostilities, and as a result of the cancellation of many munition contracts and the curtailment of others, the trade has become somewhat disorganized. Many builders of machine tools who have been making machines for shell plants, have received instructions to suspend operations. In some cases efforts will be made to have the purchaser accept delivery, but the general supposition is that the Government War Boards will decide on some arrangement whereby satisfactory adjustment may be made for all parties. The tendency appears to be to suspend all unfinished war work affected by recent developments, and unless tools are urgently requested for delivery, they will remain unfinished pending a settlement. Few of the dealers here have been hit with the cancellation of tools, as the buying of late has been almost exclusively for American business, and work on this class of shell will likely continue for some time. The sudden falling off of munition work has been reflected in the general supply business, and activity in this demand has shown a marked decrease. However, a fair volume of regular sales are reported and dealers are generally optimistic. Many shell plants are in the market for the disposal of their equipment.

No Market in Scrap

Operation here in regard to the trading in scrap are confined to immediate requirements where the placing of the material is assured before the purchase of the same. "We are virtually flooded with offers of old material but invariably the price asked is abnormally high and sales are not made," remarked one dealer. "We have just received an offer for the purchase of a quantity of copper scrap but the price mentioned was out of the question. It is very improbable that we would even accept material at prices quoted unless we were assured of an immediate market for the same." This seems to be the prevailing condition of the market, and heavy trading is at a standstill. Speaking of copper, Frankel Bros. stated that 18 cents was just as good as 21 cents, as present quotations could only be given as a nominal guide, the actual assurance for the prompt transfer of the metal being the essential requirement. Copper is quoted one cent less this week, the range being cents was just as good as 21 cents, as heavy. Stove plate is the only other scrap affected, the price asked being \$28 per ton, a decline of \$2 per ton. While most scraps are nominally firm dealers anticipate a decline to lower levels.

POINTS IN WEEK'S MARKETING NOTES

U. S. government is not yet cancelling orders on which work has been started, but where deliveries have not been yet made, cancellations are in order. It is estimated—that cancellations and adjustments to date amount to a billion and a half dollars.

Practically speaking, the entire priority and preference system in the United States is wiped out.

To-day the insistent demand for steel comes from jobbers and builders of automobiles. Experts who look well into the situation warn the public against believing that the first "flash in the pan" rush of peace orders is a criterion of the volume of trade to come regularly to the mills.

United States government is not inclined to spend very much money in high-priced material in order to sustain the steel market. The railroad administration and the fleet corporation both show a decided tendency to buy at bottom figures.

Several dealers in machine tools and munitions shops supplies find that they are quite heavily stocked with war material that will be worth only its scrap value. Munitions plants in several cases have approached dealers asking them to take back war supplies, but this will not be done.

Imperial Munitions Board is starting to dismantle its plants, the aviation division being the first to go. A large quantity of machine tools will be brought on the market.

Scrap dealers are out of the market this week as they were last. Dealers who tried the Chicago and New York markets for an outlet were informed that they were wasting their time in the effort.

SOME POWER NEEDED TO STABILIZE PRICES

Trade Thinks That Time is Not Opportune For Removal of Restrictions

TORONTO.—The removal of all restrictions on trade, and the making of it unnecessary to secure licenses or permits is expected daily. There is a strong feeling in Canadian trade that the War Trade Board should not cease office so soon. There is evidently a need right now for some such organization to remain in control and stabilize prices for some time to come.

Munitions contracts on American order are still running as though the war were still at its height, the only difference being that shipment is not now being made to coastal points, but the product of the shops in some cases is being stored at the point where the shell is finished, a railway embargo making this necessary.

The Machine Tool Trade

"There's a man down stairs who wants to buy a lathe." "Bring him up," came the quick answer, and the customer had the right of way. A man who is out to buy lathes or any other machine tools this week in Toronto is a welcome visitor. It is too early, the trade points out, to expect that the demand for equipment for other than war shops shall have commenced to come in. In many cases the dealers are having a pretty busy session just now trying to get their cancellations straightened out and the necessary adjustments made. For some time past some of the larger dealers in United States would not sell at all with a cancellation clause in their contracts. This may have resulted in the loss of a few sales, but it works out well now, in that these firms have no cancellation or adjustment problems.

There are several concerns that will have to take some time to have all their adjustments, following cancellation, made, as they have had work farmed out in a good many shops all over the country, and it is now in all the varying stages of completion.

Supply houses are still selling to the machining plants, although it is hardly necessary to state that the sales are all made pretty close to the wind, as these shops are mapping it out that they shall not be stuck with any of the supplies that are purely war equipment. It seems somewhat of an anachronism to see shops with American orders turning out shells the same as when the war was on. Some of the shops have shut off Sunday work, but otherwise the three shifts are coming and going just the same as they have been for several years. These shops seem to think that they will be told when to quit work, and in the meantime all they have to do is to keep on producing. Shells on American order are being stored at the Exhibition grounds in Toronto instead of being sent from here to the shipping point for American goods. This is due largely to the fact that there is an embargo on against such shipments taking up car space at present.

The Scrap Metal Trade

The word scrap metal trade is simply nominal. It may be called that because there is nothing else to call it. But there is no trade in connection with the whole works. There is little doing. "Every figure that you quote to-day," stated Frankel Bros. this morning, "is normal. You might be able to put a deal across at some of the figures, and then again there is the big chance that you could not." One of the dealers called up Chicago the first thing this week to find out if there were an opening there for a fairly large amount of material he had in sight. The answer was "Get off the line. You might as well talk to the wall. You're only wasting our time and your own."

Pig tin is coming down and will soon be classed as lowly metal. It has had a rather wild and meteoric career during war times, but its palmy days are past. Quantities are sold in New York now at 71, which is really a drop of about 34 cents in the last two weeks. The chances seem to be that it will keep on in this direction until it has reached a level at around 50c, and it may stay there for some time. Even that figure is well above the pre-war price. For a ten-year period the price of tin has been about 37½ cents, not counting war time inflation.

The Matter of Prices

A good many firms are offering to sell to the warehouse men instead of buy from them. Several places using sheets had contracts with the Imperial Munitions and they have this material now and want to place it. There is an element of uncertainty in the situation this week that is quite noticeable. With the removal of restrictions of trade it is hard to forecast which way prices will jump. It seems very certain that all such things as licenses, priorities and ratings will go by the boards very shortly, and the trade generally is not certain that it is well that this should be the case. One dealer took the case of sheet tin. The government price was $7.50 per box, and when the restrictions were taken off the price at once went to $10 per box. "That price jump," stated one warehouse man, "is not based on common sense. It is simply a frantic effort to keep up the morale of the trade and get what business they have on their books out at a good price."

He also took the case of steel bars, which form one of the greatest lines in the trade. "The present Pittsburg price is $2.90, and the present Canadian price is $4.15. That means, with freight and duty a difference of 55c per hundred against the Canadian maker. There is a danger that Canadians will cancel their orders here and place them in the lower market. There will have to be more of an equalization than that, or we will have hard work keeping orders for the mills here.

CANADIAN MACHINERY asked the sales manager of one of the largest Canadian plants how he would explain that situation. "We won't explain it," was the answer, "we will meet the American mill on the basis of dollar for dollar. We expect to do it and I am certain that we can do it."

Officials of the United States Steel Corporation that are planning the big mill at Ojibway are sending out letters just now to dealers and users of steel products making inquiries as to the amount of material that is being used in various lines. The idea apparently is that they should be acquainted with the requirements of this country before starting operations.

IMPERIAL MUNITIONS BOARD PUTS LOTS OF TOOLS ON THE MARKET

THE Imperial Munitions Board has made the announcement that they are going to liquidate their entire business properties as soon as possible. In fact, some days ago at Ottawa, Sir Joseph Flavelle stated to this paper that the Imperial Munitions Board existed now simply for the sake of going out of business.

The first break will likely be made in the aviation department, which has a number of well-equipped establishments, where a large amount of machine tools and supplies have been put in. As a matter of fact the lists are being prepared now, setting forth the machinery that is contained in these shops. These lists will be forwarded to the various places where purchases will most likely be made in the near future. When the dismemberment of the big establishments also starts, the chances are that there will be some crowding of the machine tool market. A number of the machines in the possession of the aviation department have never been taken out of their crates, and others, although they have been placed in the shops, have never been used.

Offered to Sellers

A representative of CANADIAN MACHINERY talked with one of the officers of the board at the Imperial Oil building on Church St., where the headquarters of the aviation department are situated. Work was in progress in the offices there in connection with the drawing up of the lists.

"We are getting ready now to offer the equipment in all the shops that are under the direction of this department," stated the official. "At present we have the following shops that will be dismantled and sold: Deseronto, Camp Borden, two at North Toronto (Leaside and Armour Heights), Beamsville, three in the city (the engine repair park on King street, the airplane repair park on Atlantic avenue, and the motor transport on Dupont street."

"How about the dealers who sold the equipment? Were there any cancellation provisions with them?"

"In some cases," replied the official. "As a matter of fact we followed the following programme in every case: The manufacturer of every machine had a chance to take the machinery back, but in no case was this done. They claimed they did not want them, and so we are going ahead to dispose of them by ousting them."

General Purpose Material

There is considerable general purpose machinery in the lot, and the chances are that the throwing of it on the market at this time will have a tendency to flood the situation for a time. Speaking of this aspect of the case Mr. F. W. Evans, the Toronto manager of the Canadian Fairbanks-Morse Co., stated to CANADIAN MACHINERY that there was no way out of the situation. "We have to look at the thing as it actually is and face it. We have been at war for four years. All the firms have done a big business. They have not lost money On the other hand they have made it. Now, in a period such as we are passing through we can expect to encounter situations where we are not going to make money. On the other hand we can expect to meet situations where we will lose money. But then, take the whole four years, put your gains down one side and your losses below them and subtract, you will find that you have a good margin left, and that is the only way to deal with the present situation."

Might Store Machinery

From another source the suggestion came that as the Canadian government had a commission overseas looking for trade, it might be a good idea to store some of the equipment, and hold it in preparedness in case something should turn up that would need equipment in a hurry. However, it does not seem likely that such a scheme will be entertained, as the Imperial Munitions Board is apparently out to get rid of their entire stock, and trade in as short time as possible. From what CANADIAN MACHINERY could learn, the machine tool dealers were not counting on buying in any of the equipment from the Imperial Munitions Board.

Where the Loss Comes

"Here is is something you should have," remarked the manager of one of the big Toronto concerns to CANADIAN MACHINERY to-day. "A number of the munition plants around the country that have had their contracts cancelled are writing to us asking if they can be relieved of the supplies that they have left over, and their accounts credited with the amounts. In one case a firm wrote in here giving a list of the material they had. They stated that on receipt of word from us they would ship this material and have it replaced by standard supplies. They got the word from us, but not in the way they expected. We are stuck ourselves with a fairly heavy stock of supplies that will not be any use beyond the value of the material that is in them. The munitions plants," stated this dealer, "should be prepared to shoulder their share of the losses. We certainly do not intend to take back any of these goods where a bona fide sale has been made. We took the big chance in carrying a big stock of this stuff all the time so that the munitions plants would have a good supply to draw from all the time and delays avoided in production. Now that the demand is off for these special kinds of supplies, it's up to them to shoulder and absorb their small loss, and we will have to do the same in a much larger way. Such things as hobs, chasers, etc., will not be used in any operation that we know of at present, and we are certainly not going to absorb the loss that should fall on the shell shops." A hob that was worth about $16 a few days ago was much sought after in the shell world. To-day the dealer turns it over, gives it an imaginary weighing balance in his fist and reckons that the high speed in it will bring in a pinch about one dollar. It's the old case of the Bryan 16 to 1 ratio, with the man who put up the $16 on the losing end.

PITTSBURGH HEARS PRIORITIES WILL BE SWEPT AWAY NOW

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Nov. 28.—The policy of the government as to reconstruction is probably as well defined as such a thing can be only a fortnight after the sudden cessation of hostilities, but it does not follow that the course of affairs will follow the desires of those who have undertaken to regulate matters. Necessarily, the powers of the government are much more limited than they were in the war period.

As to cancellations of war orders, the government continues to follow the policy outlined in last report, of refraining from cancelling orders on which work is being done, if that would result in idleness of plants or workmen. How long this policy can be continued is naturally a question, for the object is to allow activities to change from the making of war to the making of peace material, and it cannot be determined how soon a sufficient volume of peace work for the iron and steel industry will develop. The government can keep up the war work for a time, but of course not for any great length of time.

Cancellations of orders on which work had not been started has proceeded very rapidly. The cancellations and readjustments to date, including all classes of material, probably amount in value to $1,500,000,000 or more.

Priorities and Preferences

Practically speaking, the entire priority and preference system is wiped out. The formal order is that the preference list is discontinued and the priorities, both individual and automatic, are annulled, except orders for the Navy Department, the Fleet Corporation, and railroads and telephone and telegraph lines. With the pressure removed by other priorities being discontinued, no producer will have any difficulty in making deliveries at times desired by the activities still accorded priority, hence those priorities are merely a safeguard, and deliveries would probably be made just the same if there were no priorities at all. If demand should remain such as to keep the mills continuously busy, the decision as to which material shall be shipped first is left to the mills, thus restoring the old order of things. In normal times the mills do not fill their orders in rotation, but in accordance with their knowledge of the needs of their customers, the object being to maintain the operations of all customers as equitably as possible.

Character of Present Demand

There has developed what appears to be quite an insistent demand for steel, but this demand may be misleading if it is not scrutinized carefully. Naturally the first flash of demand, after the mills have been crowded to capacity, and more, for a trifle over three years, many consumers have been starved as to steel, and prices were at a war-time rather than a peace-time level, cannot be expected to reflect in either volume or character, the demand that is to be experienced in settled times over a period of years. That there will be for quite a while say from two to five years, a demand for approximately all the steel the industry can produce, is the common opinion, but this demand cannot necessarily be expected to develop at once, because the matter of price plays such an important part. There are all classes of buyers as to the period in which they expect to liquidate their purchases. As illustrative, two extremes may be cited, the jobber who has customers demanding material at once, and who can, perhaps, buy from a mill and have the material sold and paid for within thirty days, and the investor in a highway bridge, certain to bring in revenue for 20 years, and which, therefore, can be undertaken with the idea of its returning the capital invested in installments over a period of twenty years. The one buyer of steel need scarcely look ahead thirty days, while the other is disposed to look ahead twenty years. A well rounded-out demand for steel requires that there be buyers of all descriptions.

To-day the particularly insistent demand for steel comes from jobbers and from automobile builders. Other classes of buyers are not conspicuous in the market. The jobbers are importuning the mills and mulling over stock lists, being glad in some cases to take even a single ton of material that may chance to be in a mill stock. The jobbers show no disposition to build up their stocks except in items that are very deficient, and their general policy is to have their inventories as light as possible on January 1 for several reasons, one being the manner in which profits and taxes for 1918 must be computed. As to the automobile builders, there is believed to be a heavy demand for cars, and the makers have notified the public that they must not expect reductions in prices of cars before the end of the spring selling season. For the cars to be built in the next few months the automobile builders need not be particular as to prices paid for steel, for they know they can make a profit in turning into cars the steel they can buy on the present market.

The present flash of demand, therefore, does not bear the earmarks of permanence. The real issue is as to when the investment buyer will come into the market, when there are buyers of steel who expect to secure the return of their capital in periods of five, ten and more years. Such buyers will wait if they think the investment will cost them 10 per cent. less six or nine months later. They want to see a rising market rather than one which is likely to decline if it moves at all.

Price Prospects

Steel makers presumably know their own business, and for several weeks past their talk has been that the government ought to set minimum prices for steel, for the transitionary period, to replace the maximum prices that have hitherto obtained. There is every evidence that the steel trade expected a slump in prices if there were not artificial control. It has become established, however, that the government will not and cannot set minimum prices. At first it was thought the Sherman law, against conspiracies in restraint of trade, might stand in the way, but the second thought has been that even if it were not for that law, the United States government cannot set minimum prices when it has no means of punishing anyone who would cut prices and thus violate the order. The government has been rather strenuously engaged of late in an effort to prove to Germany that it was not "bluffing," and it would hardly be in keeping with its traditions for it to undertake now to issue orders which it could not enforce. This new thought leaves it that the War Industries Board may continue to fix maximum prices for a time, as it has done hitherto. The present limits were set to run for deliveries through December 31, and prices might therefore be fixed in the next few weeks to run for the first quarter or first half of the new year. The common expectation in the past few days has been that this will be done.

THE WEEK IN INDUSTRIAL HAMILTON

Special to CANADIAN MACHINERY

HAMILTON.—In the death of George Brannum Dowswell, which occurred at his residence on the night of November 20, Hamilton industrial circles have sustained a distinct loss, as he was one of the city's pioneer manufacturers and always had its industrial development at heart.

Born in Pickering, Ontario, 68 years ago, he spent his early years at that point, and later came to Hamilton, where as a young man he showed a strong bent for things mechanical, and also gave much promise of going far in his chosen field, as he had a fund of executive ability and was a splendid organizer.

About this time there was a great demand for what were then known as "modern laundry utilities," such as wringers, mangles, tubs, etc. Young Dowswell had the foresight to see what a splendid field there was to be developed in the making of these articles, and he became identified with Mr. J. Cummer, now of Toronto.

The Dowswell Manufacturing Company was formed, and from the start, under the careful management of Mr. Dowswell, its success was assured. For a good many years Mr. Dowswell was president of the company. Later a reorganization was effected, whereby Mr. Cummer withdrew, and the new firm was known as Dowswell, Lees & Company. The same policies were adhered to, with the result that through Mr. Dowswell's efforts the company became one of the best known in Canada in its own line.

Of late Mr. Dowswell's health had become indifferent and he was obliged to take a less active part in his business affairs, which he entrusted to his junior partner.

By religion Mr. Dowswell was a Methodist, and a staunch member of Wesley Methodist church. It has been said of him that he was "a truly consistent Christian, who carried his religion into his daily life, without parading it."

Mr. Dowswell was well known fraternally, having been a member of Acacia Lodge, A. F. & A. M., and also took an active part in the affairs of the Ancient Order of Foresters.

Of a family of twelve brothers and one sister, only one brother, Fred, of Hamilton, and his sister, of Dresden, Ontario, survive, besides his wife and one daughter, Mrs. Hebert S. Lees.

The funeral took place from his family residence on Saturday afternoon.

WANT PRICES TO BE HAULED DOWN NOW

Hamilton Firms Think That Ottawa Should Act on Their Behalf Right Away

Hamilton.—While those Hamilton manufacturers who have been working almost exclusively on munitions since the outbreak of the war are not in anywise pessimestic over the future, it can hardly be said of them that they are exuberantly optimistic. The apparent failure of the government to appoint war boards to stabilize the prices of various materials is assigned as the chief reason for this feeling of uncertainty that exists.

The chief grievance of those Hamilton manufacturers who were questioned concerned the utter failure of the government to do anything to control the price of pig iron, a material that enters into every form of manufacturing. It was pointed out that in the United States pig iron has been selling for $33 per ton, while throughout eastern Canada the price has varied from $46 to $50 per ton.

In the face of such a disparity as this, Hamilton manufacturers want to know how they are expected to compete in the foreign markets with their American rivals. On products in which there is little material and more work, the disparity in the price of pig iron is not so keenly felt, but on products where the material is in the preponderance over labor, the disparity makes things very difficult; indeed, one manufacturer said it was fatal to the efforts of Canadian manufacturers who had an eye on foreign trade. "We just haven't got a chance at all, he said. William E. Blandford, secretary-treasurer of Brown, Boggs Company, said that the difference in the price of scrap iron in Canada and the United States was also acute. The Canadian price was $40, a figure which he held to be outrageous.

The grievance of local manufacturers was all summed up in Mr. Blandford's apt words: "If the government expects us to come through the period of reconstruction without difficulty it must do its part by stabilizing prices, otherwise conditions are not going to be so good as is expected. Reconstruction is not a mere formula that is going to work out everything itself. There must be war boards to keep things steady for months to come. How can we be expected to compete in the foreign markets against American manufacturers with the present disparities existing?" he asked.

Should Buy Machinery

Mr. Blandford, as did also several other manufacturers, said he was strongly of the opinion that the government should purchase the munition equipment and store it against the time when it might be needed again. The United States government was doing this, and in doing so was acting wisely, he thought.

Mr. Blandford said there was no doubt that many single-purpose lathes which had been used for munitions would have to be scrapped.

In the last issue of CANADIAN MACHINERY an item apeared in the Hamilton correspondence stating that the Canadian Cartridge Co. will make steel barrels, and also stating that "This company will be the only one in Canada to make steel barrels."

This latter statement is, of course, not correct, as the Smart-Turner Machine Co., Ltd., of Hamilton, have been manufacturing steel barrels for the past four years, and have developed a substantial industry in this particular product.

CANADIAN MACHINERY regrets that the statement should have appeared in the way it did, and assures the Smart-Turner Co. that it was entirely an error on our part.

HAMILTON GOING AFTER EXPORT TRADE

And For That Reason Lyons Fair Will Be Centre of Interest

Hamilton.—Keen to develop all the foreign trade they can possibly handle, more than a few of Hamilton's manufacturers have already taken steps to be represented at the annual fair to be held in Lyons, France, on March 1, 1919.

The greater volume of the output of Hamilton's industries in pre-war days was of a domestic nature, and little or no attention was paid to export. But if the reconstruction period is to be passed through without difficulty, it is argued that manufacturers will have to pay the utmost attention to export and foreign markets.

At a special meeting of the local branch of the Canadian Manufacturers' Association, the importance of being represented at the Lyons fair, either by exhibit, catalogue, or photographs, was impressed on the minds of local industrial heads, and the result was that several signified their keenness to heed the speaker's advice.

If there is one country in Europe that will have to be built up, that country is France, it was pointed out, and local manufacturers were not slow in appreciating the fact that the best way they could get samples of their goods placed before the buyers on the French market was being represented by Lyons fair.

The Frost Wire Fence Company, Steel Company of Canada, National Steel Car

Continued on page 67

The "WILLIAMS" 24" Heavy-Duty Lathe

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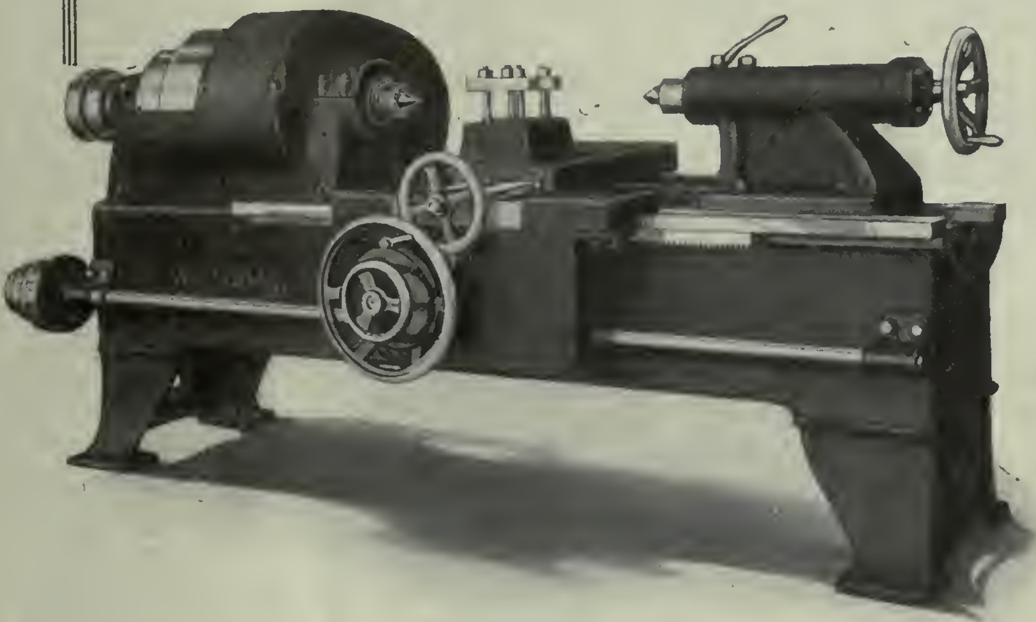

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High-Grade Electric Furnace Steel Castings

Let us quote for your requirements

The Thos. Davidson Mfg. Co.
Limited

Steel Foundry Division:
Turcot, Que.

Head Office:
187 Delisle St., Montreal

When Rearranging Your Factory For After War Work

Plan to Keep Down Your Overhead By Labor-Saving Tools

A Drum for Hoisting Materials or Hauling Cars is a Labor-Saving Tool.

The above drum can be supplied for Belt Drive, as shown, or for Electric Drive, direct connected to a motor.

It will reduce your labor costs if used for—

- Placing cars for loading or unloading.
- Moving coal or ashes to or from the power plant.
- Running cars in or out of ovens.
- Hauling cars of materials about the factory or yard.
- Conveying articles from one machine to another in course of manufacture.
- Operating an industrial shop railway, or an overhead trolley system.

Let us help you arrange your shop lay-out so as to keep down overhead.

Marsh Engineering Works, Limited
Established 1846
Belleville, Ontario

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 25
Reinforcing bars, base	5 25
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Brand steel, No. 10 gauge, base	4 80
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.	C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 31 00	$ 29 50
Electro copper	31 00	29 50
Castings, copper	30 50	28 50
Tin	85 00	88 00
Spelter	10 50	11 00
Lead	10 50	10 00
Antimony	12 00	18 00
Aluminum	46 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 8 00	$ 8 00
Plates, 3-16 in.	8 50	8 50

WROUGHT PIPE

Price List No. 37

Standard Buttweld

Per 100 feet	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$20 00	$20 00
Copper, crucible	23 50	24 50
Copper, heavy	23 50	24 50
Copper, wire	23 50	24 00
No. 1 machine composition	22 00	22 00
New brass cuttings	15 00	15 50
Red brass turnings	18 00	18 00
Yellow brass turnings	13 00	13 00
Light brass	9 00	9 50
Medium brass	13 00	12 00
Heavy melting steel	24 00	22 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	40 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	25 00	20 00
Pipe, wrought	22 00	17 00
Car wheels	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	28 00	19 00
Cast borings	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	7 00	8 00
Tea lead	5 50	5 75
Aluminum	21 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers ... List plus	20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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 ... add	20
Machine screws, o. and fil. hd brass ... add	25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ... plus	10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws ... list plus	20
Collar screws ... list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts ... add 40,	10
Cold pressed nuts to 1½ in. ... add	$4 50
Cold pressed nuts over 1½ in. .. add	7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G." per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 50%

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	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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.	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	...
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES

TRADE GOSSIP

Canada Iron Foundries Extend.—The contract for the erection of a $75,000 one-storey brick building for the Canada Iron Foundries, St. Maurice street, Three Rivers, P.Q., has been awarded to Nobert, Dugre, and Arsenault.

Projected Oil Refining Plants.—Alternative plans are being considered by importers of oil from the Orient, of establishing plants for the refining of oil. One plan is to refine only, while the other would include rendering.

Electric Sawmill at Nelson, B.C.—A sawmill, with a capacity of 30,000 feet per day, entirely driven by electricity, is nearly completed. It was expected to be ready for operation this week. Granite Siding will be the point of shipment.

New Post Office for London.—Semi-official news from Ottawa states that a start is likely to be made shortly in the erection of the central post office. A site was procured just before the war broke out, and it is now expected that the building will be proceeded with speedily, and the present congestion relieved.

Box Factory for Prince Rupert.—The announcement comes from Mr. F. L. Buckley, manager of the Buckley Bay and Khyex Mills, that he has just completed arrangements to lease the G.T.P. ship shed at the dry dock. It is proposed to start a box factory, cooperage, and general woodworking plant as soon as arrangements can be completed.

To Handle Extra Traffic.—With the completion of the $20,000,000 plant of the Canadian Steel Corporation that is being built at Ojibway, the Canadian Pacific Railway are looking for property for the extension of their tracks and freight sheds. New docks are in course of construction at Ojibway, and in the spring several hundred workmen's homes will be built.

The Trussed Concrete Steel Co. of Canada Limited, with head office and works at Walkerville, Ont., represented in Quebec by G. B. Reynolds, of Montreal, has received the contract for all steel sash work on the government buildings at Ottawa. This metal sash throughout will be copper coated by the Schoop process, the contract for this work being done by the Metals Coating Co. of Canada.

Large Building Operations.—It is rumored that Toronto is to be the scene of intense activity in the building line. The amount of money involved is said to be $30,000,000. The Ontario Wrecking Co. has taken out a permit to demolish nine dwellings, a church, and stable in the vicinity of Buchanan and Hayter streets, and on this site it is reported a department store will be erected to cost $10,000,000.

Wants 10,000 Men.—It is estimated that 10,000 men can be absorbed in the lumber camps east of Fort William. The Lumbermen's Association have told the Dominion government that the men must be all forthcoming within two weeks if they are to be of use for this purpose. They have sent a circular to their members asking them to get into touch with the nearest munition plants. Current wages for lumbering are to be paid, arrangements having been made with the Minister of Labor to this effect.

To Interest British Capital.—Efforts are being made here to induce British capitalists to purchase the war munitions plants in Canada and create new peace industries. The contracts now being filled will be gradually reduced so as not to cause congestion in the labor market. Sir Joseph Flavelle will have full charge of the demobilization of the munitions industry in Canada under the Imperial Munitions Board. The total British war orders placed in Canada amount to $1,-300 000 000.—"Montreal Gazette."

Supplies Burned.—Early in the month damage to the extent of about $100,000 was caused by a fire originating from defective wiring, to one of the large storage buildings situated on the King's wharf at Quebec. A large quantity of supplies for the lower St. Lawrence lighthouses, and medicine for la grippe sufferers of the district, stored in the basement, was saved, but large supplies on the top floor were totally destroyed. The value of the stores was approximately $75,000, the remainder being on the building. The store house was of stone, built in 1820.

Paper Mills Can Take Men.—The Canadian Pulp and Paper Association has received a request from Hon. D. G. Robertson, Minister of Labor, for information as to the number of additional men the industry can employ this winter. Normally the industry employs about 25,000 mill and office employees, and at certain times in the year, about as many woodsmen. It has contributed 2,500 men to military service, most of whom have been assured of their positions on their return. As this will take some time, they can employ several thousand men immediately.

Operating as Usual.—Darling Bros., Montreal, expect to complete their contract on the 4.7 anti-aircraft shell for the American government. No instructions have been received to the contrary and employees have been notified that the plant will operate as usual until further notice. If their present order is to be completed the plant will operate throughout the winter. The night shift will be continued unless advice is receiv-

CANADA'S FUTURE RESTS LARGELY IN HER OWN HANDS

We Hold the Cards, But They Must Be Properly Played —The Testing Time is at Hand Now

By C. GRAHAM DRINKWATER, Vice-Pres. Canadian Fairbanks-Morse Co., Ltd.

You ask what is in store for us as a nation, and my humble answer must be: "Just exactly what we have the ability to make it. We hold the cards but they must be properly played. The test is at hand. We rose to the occasion on the outbreak of war. Our army overseas has made a glorious record, and our army of workers at home has set a new standard in the production of war materials. Canada's prestige never stood higher, and if we apply the same breadth of vision to the period of reconstruction, our success will be assured."

ed to the contrary. Their domestic activities are quite extensive at the present time, and should shell work cease, it is probable that quite a number of men could be absorbed in the general work.

St. Thomas Goes After Industries.—St. Thomas is sending its commissioner, Mr. McMahon, to New Jersey, where several likely opportunities to secure new industries for the town exist. He was authorized to offer special inducements to certain industries there to locate in St. Thomas. There will be several factories available when the existing munition works close down, which will be very shortly. One of the industries that will probably be offered inducements is a large silo and granary manufacturing concern. The Board of Trade and Industrial Committee will probably hold a membership campaign this winter.

This Plant to Work All Winter.—"All men and women employed in Winnipeg shell factories as metal trades workers will be needed during the coming winter." This statement was made by L. B. Barrit, general manager of the Vulcan Iron Works. The Vulcan Iron Works, Manitoba Bridge and Iron Works, and Dominion Bridge and Iron Works, who have a contract for $500,000 placed with them by the American government, employ 500 men extra to fill the contract. T. R. Deacon, manager of the Manitoba Bridge and Iron Works, thinks that there will be no change in the number of people employed by the metal trades, due to the end of the war.

Discarding List Welcomed.—Canadian manufacturers, who have been inconvenienced by the Preference Act in the U. S. A., expressed great pleasure when it was discontinued. The Canadian Manufacturers' Association, commenting on the announcement from Washington, said that it meant the cutting of a vast amount of red tape which was necessary in war time, but not in peace. The officials of the Canadian Manufacturers' Association do not look for any hard times in Canada during the reconstruction period. As they say, a country that could do what Canada has in the war is capable of taking care of the present situation and bringing things back to normal very soon.

Notice of Removal.—The Canadian Bond Hanger and Coupling Co., formerly of Alexandria, Ont., have sent out the following notice to the trade: "Under date of July 6th we advised you of our pending removal to our new plant at Toronto. Continued orders from the trade made this move impracticable at that time without causing you considerable inconvenience with respect to deliveries. We are now transferring our stock and equipment from Alexandria, and our office will be established at the new location on November 20th, after which date will you kindly address all communications for us to Villiers and Munitions Streets, Toronto, and greatly oblige. Toronto telephone: Adelaide 166."

Selling Peace Lines.—According to reports coming from heads of departments of firms dealing in machinery and transmission, there have already been a number of inquiries for the fitting out of plants that will turn out work separate and apart from the war industries. "I have sold motors," stated one dealer, "to a firm that has a contract for the building of fifty houses in one of the best industrial centres of Ontario. There are inquiries coming in from similar firms elsewhere. The flax industry seems to be in for a period of development, and although we do not handle the special machinery for this work we are interested in the transmission end of the business, and it is for this that the inquiries are coming."

Letting Staffs Out.—From a survey of the situation in Toronto, it would seem that about twenty per cent. of the munitions workers had been let out so far. The figures may go as far as 25 per cent., but not over. In other places where production is still going on, Sunday work has been dispensed with. There is a disposition on the part of many of the plants to try and hold the better mechanics whether they have immediate use for them or not. In a good many instances it is found that the foreigner is being let out ahead of the English-speaking worker. It is anticipated that the process of discharging the employees of the munitions plants will proceed more rapidly in the next week or so. It is estimated that Toronto has had about 26,000 munitions workers, and that at present between 6,000 and 7,000 have been let out.

Montreal Cancellation.—The St. Lawrence Machinery Co. received instructions from the Imperial Munitions Board to cease operations on the 6-inch British shell last Saturday night. They had expected to complete their contract, involving about 2,000 more shells, but these will now be a factor for future adjustment. This firm has been operating two plants, one of which has been leased for the specific purpose of munitions making. The original plant of the St. Lawrence Iron Foundry, which has been utilized for shell production for nearly four years, will revert back to grey iron foundry work, many of the old moulders and foundry men having been engaged in the shell activity. Work in connection with the foundry will be started as soon as settlement is made regarding shells now on the premises. All of the foundry equipment is still available and operations can be resumed as soon as the flooring and machinery is removed.

Disbanding Flyers.—Within about the end of January next, the bulk of the members of the 12,000 mechanics and cadets who form the personnel of the Royal Air Force will have been disbanded and back in civil life, according to an authoritative announcement at the local headquarters of the R. A. F. Demobilization commenced actively, and when in full swing 400 men will be returned to civil life every day until the force is disbanded, except for the small office staff, which will be retained to deal with the pilots returned from overseas who must be discharged in Toronto. The R. A. F. of Canada has grown to a multi-millionaire corporation, and the property which the corps owns in Canada at the present time is stated to be between $30,000,000 and $40,000,000, much of which, as capital stock, has been written off in the training of pilots. The cost of training each pilot is thus shown on the books of the force as somewhere in the neighborhood of $12,000, and the property will be worth only its salvage value unless some means can be found to dispose of it.

PERSONAL

Corp. Gordon D. Richardson, assistant sales manager of the T. A. Willson Co., Reading, Pa., was wounded in the hip by machine gun fire during the last few hard smashes at the Hindenburg line. He is improving at U.S. Army Base Hospital, Portsmouth, England. Corp. Richardson is well known to the Canadian industrial trade.

Mr. Ed. Fitzgerald, for some time past connected with the Imperial Munitions Board at Ottawa, has received an important appointment with the Hudson Bay Co. He was, previous to joining the Imperial Munitions Board, assistant general-purchasing agent to the C. P. R., under Mr. E. N. Binder. It is understood that he will leave for the West towards the end of the year.

The steel trade will learn with sincere regret of the death of Lawrence Johnston, assistant purchasing agent for the Steel Company of Canada, Hamilton. He had been with the Steel Company for the last ten years, and was well known, not only in Hamilton, but in the whole district covered by the industry. He was taken with influenza, after which pneumonia developed. He had been sick only a week. He leaves a wife and two children.

MARINE

Vancouver, B.C.—The Northern Construction Co. are constructing an addition to their yard, to cost $44,000. This company is building 5 vessels of 1,500 tons d.w. for the French Government.

New Westminster.—Good progress is being made on the five 1,5000-ton wooden vessels for the French Government, building at the New Westminster Construction and Engineering Co. Four of them are in France, and three of these planking and ceiling are in progress.

Toronto.—The Canadian Car & Foundry Co. filled the order for the 12 mine sweepers for the French Government in such a satisfactory manner that they have secured a further order for a number of steel steamers for the same Government.

Vancouver, B.C.—A meeting of residents of the Yukon passed a resolution, calling on the Canadian Government to confer with the U.S. Government on the question of placing a lighthouse on Vanderbilt Reef, in Lynn Canal, where the "Princess Sophia" was recently lost.

Montreal. — The vice-president and managing director, Mr. J. W. Norcross, and two other directors of the Canada Steamship Lines, have left Canada for England. It is stated that the London Advisory Board has invited them to confer on the question of continuing the ocean trade of the company, which came into existence since the beginning of the war. The company has at present twenty vessels in the Atlantic trade.

Washington. — Chairman Hurley, of the Shipping Board, who sailed for Europe to prepare for the returning of American troops to this country and for moving needed food supplies to the war-famished nations overseas, also plans to seek an international agreement between the governments, shipping interests and labor organizations of the principal maritime powers for standardization of seamen's wages and working conditions. It was said that Mr. Hurley expects to propose that the American laws and the agreements between the Government and the seamen's unions on these subjects be accepted as the standards, and it is understood that the American Federation of Labor and the British Seamen's Union are prepared to support the proposal.

Port Arthur.—Launching of ocean-going tug "Victorie" took place at the plant of Port Arthur Shipbuilding Company, Limited, Port Arthur, Ontario, November 8th, Mrs. J. T. Emmerson, of Port Arthur, acting as sponsor. The "Victorie" is an all steel ocean-going tug built to Lloyd's classification, designed to develop 800 horsepower. General dimensions are as follows: Length B.P., 119 ft.; breadth, molded, 26 ft.; depth, molded, 26 ft. 6 in. Propelling machinery consists of a triple expansion surface condensing engine having three cylinders, sizes 15 in.; 29 in. 47 in. x 36 in. stroke. Steam is supplied by two Scotch boilers, diameter 11 ft., length 11 ft., each with a working pressure of 100 pounds. This tug is to be delivered before the close of navigation this year.

IN INDUSTRIAL HAMILTON

(Continued from page 636)

Company, Canadian Cartridge Company, Oliver Chilled Plow Works Company, Sawyer-Massey Company, International Harvester Company, Sanford Clothing Manufacturing Company, and others, will all avail themselves of the peculiar and timely opportunities which the Lyons fair holds out for the Canadian manufacturer who is anxious to develop foreign trade.

WE SHALL TELL YOU WHEN TO CEASE IT

And so Turning Out of the American Munitions Contracts Keeps Up

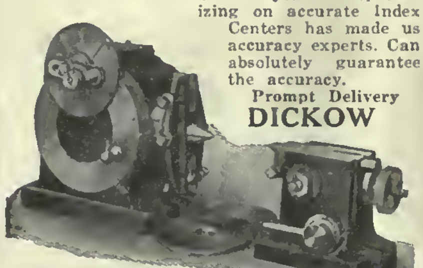
Hamilton.—Just how much longer local companies will be engaged on munition work is a question, but the fact remains that those which are working on American government orders have shown no cessation, while several of them have received intimations from Washington, it is said, that ensures their continuing on shell work for many weeks yet.

One such company is the Tallman Brass & Metal Company, which has worked almost exclusively on munition work since the outbreak of war, and which only a short time ago received large shell orders from the American government.

Addison H. Tallman, manager of the company, said that not long ago munition equipment costing $150.000 had been installed, yet he would not like to hazard how much longer the company would continue on such work.

Would Notify Them

Another manufacturer, working on American munitions, grew apprehensive when the armistice was signed, and wired Washington to find out what lay ahead of him. The reply he received from Washington was to continue on



shell work without any let-up. "We shall tell you when to cease," the message ran.

That these orders must soon be cancelled, however, was generally admitted.

Mr. Tallman said that the fixture department of his company had sufficient work on hand to keep it busy for four months. Much of this work would be for foreign markets. With the automobile industries coming into their own again, however, Mr. Tallman said that his company should have plenty of work to do in making brass attachments for autos. The activities of the shipbuilding industry would also give the company much to do, as it is in a position to make all sorts of brass fixtures for vessels, such as binnacles, signal lamps, cabin railings, clock-cases, etc. Mr. Tallman said that he had received word to slow up on shrapnel bullets for the Imperial Munitions Board. Only six men would be affected, and would be easily absorbed by other departments once the work was stopped.

Cutting Off Forging

Manufacture of all six-inch shells for the Imperial Munitions Board ceased in Hamilton last Thursday, and shell forgings ended on Saturday night. The largest maker of these was the Dominion Steel Foundry & Steel Ltd. One thousand men were laid off temporarily, but will soon be back at their places again when the present equipment is removed and tools for new work are installed.

Paul J. Myler, of the Canadian Westinghouse Company, stated that no word had been received to cease making shells for the American government. Large orders are on hand, and the company expects that this work will continue for several weeks.

STEEL CO. SENDING MAN TO AUSTRALIA

George Spence Going On An Extensive Trip to Look for New Markets

Hamilton.—Believing that there are virgin markets to be developed for their smaller bright goods in Australia, New Zealand, and other places in the Antipodes, the Steel Company of Canada has appointed George Spence, of this city, to make an extensive tour of those countries to develop markets for screws, bolts, and other bright goods.

Mr. Spence, who will depart for Australia at a no distant date, is a native of Hamilton, and has been associated with the Steel Company of Canada for many years. He received his training in the sales department of the company, and showed such promise that it was not long before he was sent to New York to take charge of the company's export office at that point.

Mr. Spence will be succeeded by Mr. James, who has been attached to the Montreal offices of the company for several years.

POWER SHORTAGE FELT IN LONDON

LONDON, Nov. 27.—Shortage of power is affecting the manufacturers of London. It was thought that when the armistice terms were signed the demand for power would not be so heavy by the munitions factories. This has not helped out the situation so far as London is concerned as the manufacturers have cut out the night shift only. During the peak lead, which is between 4.30 and 6 o'clock in the afternoon, the power is so short that domestic users are handicapped by the low voltage.

E. V. Buchanan, General Manager of the Public Utilities Commission, has issued letters to all large power users asking them to cut their power by 50 per cent. at 4.30 and shutting it off completely at 5 o'clock, in order to save the situation. He points out that the domestic consumer has been sacrificing for the sake of the manufacturers and he thinks that now that the need of munitions is not great the manufacturers can shut down on their power without much inconvenience.

About twenty users of power have responded to the request and it is thought that this will enable the city to weather the power shortage successfully.

Ready for Export

McClary Manufacturing Company is already preparing in anticipation of a large export trade with European countries that Canada will get as soon as the peace terms are definitely settled. The company has shipments waiting for the removal of the embargo to be forwarded to Africa, Russia, Australia, and New Zealand. J. J. Foot, vice-president of the company, says that he looks for a good trade with these countries.

The company is also planning an exhibit at the Fair at Lyons, in France, next year, with a view to establishing trade relations with that country. McClary Manufacturing Company manufactures a complete line of stoves, ranges, furnaces, and all kinds of enamel and granite ware.

SHELL WORKER IS ONE OPERATION MAN

Editor, Canadian Machinery: In reply to your request for my opinion of the effect shell machinists will have on the qualified machinists' trade, I state the following facts:

My candid opinion is that shell machinists will be a great detriment to skilled mechanics in this way. Unskilled help on production work with the aid of gauges, etc., will take the place of mechanics, and will do just about as accurate work. The manufacturer will take advantage of this fact and keep down and reduce rate of pay.

Regarding the matter of work in toolrooms, machine and job shops, where a varied line of work has to be undertaken and completed from start to finish, the "shell buster" will be a failure, as he is a one job man, and a one job man he will remain.

Sincerely yours,
W. Pirie.

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.

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SALESMAN WITH PRACTICAL MECHANICAL and selling experience, at present employed, desires advantageous change with reliable firm. Married, age 33. Box 519, Canadian Machinery. c22m

EXPORT—EXPERIENCED SALESMAN WELL introduced with Belgian, French and Italian railroads and other important industrial firms is open for European representation. Will sail soon. Address Box 529, Canadian Machinery. (c23m)

HEAT-TREATER—SIXTEEN YEARS HARDening, tempering, carbonizing, heat-treating, with sound practical and technical experience metallurgy and pyrometry. Up-to-date methods and know how to handle men. Sound credentials. Box 526, Canadian Machinery. (c22m)

FOUNDRY FOREMAN OPEN FOR ENGAGEment, has had years of experience on best class of work. Economical production of castings, successful handling of men, mixing of metals. Can furnish best of references. Joseph Crowe, 376 Brock St., Peterborough, Ont. (ctfm)

WANTED—POSITION AS MACHINE SHOP superintendent. At present engaged in similar capacity in large plant. Desire change. 18 years' machine shop experience. Thoroughly practical. Accustomed to heavy work. Locomotive and marine credentials. Age 36. Address Box 522, Canadian Machinery. (c21m)

RETURNED SOLDIER DESIRES POSITION as mechanical draughtsman. Can do tracing and wants to learn more about machine drawing. Would be willing to start with a moderate salary if prospects are good. Am at present employed in large drafting room and would like similar position in Toronto or Montreal. Other office work would be considered. Box 520, Canadian Machinery. c22m

ASSISTANT GENERAL SUPERINTENDENT of large engineering plant seeks similar position or that of general superintendent. 22 years' machine shop practice, both locomotive and marine. Thorough mechanic. Good executive. Age 38. Disengeged November twentieth. Address Box 621, Canadian Machinery. (c20m)

SPECIAL MACHINERY

H. C. THOMAS, GENERAL MACHINE SHOP, tools, jigs and machine repairs. 301 King St. W., Toronto. Telephone Adelaide 3836. tf

MANUFACTURERS—WE CAN UNDERTAKE work to any specification—munition production equipment or otherwise. Write W. H Sumbling Machinery Co., 7 St. Mary St., Toronto

MISCELLANEOUS

Munition Manufacturers

If you have not decided what use to make of your plant, I have a good proposition that might interest you. Send address. I will call. Box 520, Canadian Machinery. (c24m)

HELP WANTED

SUPERINTENDENT WANTED AT ONCE FOR small machine shop in Toronto. Good chance for right man. Box No. 514, Canadian Machinery. c22m

GRADUATE MECHANICAL ENGINEER wanted. Only energetic and ambitious men need apply. Specialty gasoline motors and farming machinery. Knowledge of French necessary. Highest salary paid to right party. Send references and state salary desired. Apply Box 482, Canadian Machinery. (ctm)

WANTED—ASSISTANT SUPERINTENDENT of Montreal factory. Must be experienced mechanical engineer with knowledge of drafting. Give full particulars as to experience. State age and salary required. Box 527, Canadian Machinery. (c23m)

WANTED—THOROUGHLY PRACTICAL AND experienced Mechanical Engineer with executive ability for position as Chief Engineer in a large steel working plant, chiefly engaged in the production of shell and heavy Marine Forgings; knowledge of Hydraulic Presses and Pumps desirable—a good position and salary for right man. Apply Canada Forge Company, Limited, Welland, Ont.

MACHINERY WANTED

SPIKE MACHINE—WE WANT TO BUY A machine for making railway and ships' spikes. Either new or second-hand. Address, giving full particulars, Starr Manufacturing Company, Limited, Dartmouth, Nova Scotia, Canada. (c23m)

ONE SECOND-HAND GAS ENGINE ABOUT 100 h.p. Must be in good condition. Write P.O. Box 217, Moncton, N.B. (c24m)

WANTED—ONE UNIVERSAL MILLING MAchine, size No. 2 or 3. One tool room grinder, No. 2. Send full particulars to Box 528, Canadian Machinery. (c24m)

WANTED—GOOD SECOND-HAND MACHINE for straightening bars of steel from one-half to two and one-half inches. Give full particulars as to make of machine, length of service, price, etc. Box 523, Canadian Machinery. (c22m)

WANTED — SECOND-HAND AUTOMATIC screw machine, plain or turret type. Single spindle. Capacity 1⅛ or 1¼ stock. Address particulars and price to Box 530, Canadian Machinery. (c24m)

1—BELT DRIVEN AIR COMPRESSOR ABOUT 8 x 8 cylinder.
1—Lathe to take in 12 ft. between centers.
2—10-ton, hand operated travelling cranes, 38 ft. span. The National Shipbuilding Co., Ltd., Goderich, Ont. c19m

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (cfm)

FOR SALE

RADIAL DRILL, BICKFORD, 4', SPEED BOX drive, in good condition, for sale. Boving Company, Lindsay. (c22m)

FOR SALE—ONE CENTRIFUGAL PUMP, 4-inch suction; one Pickering steam governor, inch and half; 5 wood pulleys, 24 by 6-inch; 1 do., 16 by 6-inch; 1 do., 12 by 10-inch; 500 feet wire cable, three-eighths. Apply A. G. Anderson, Port Dover, Ont. (c24m)

FOR SALE—THREE NEWTON COLD SAWS in good condition. $1,500 each for quick sale. Canada Metal Co., 35 Fraser Ave., Toronto. c25m

FROG AND SWITCH PLANERS:—SIZES 36" x 12" x 14' and 36" x 12" x 12' in good second-hand condition. Box 524, c/o Canadian Machinery. (c22m)

FOR SALE — FOUR-INCH CENTRIFUGAL pump; also horizontal boiler 8' long, 42" dia., 50 x 2½" tubes. In good shape. Box 516, Canadian Machinery. c21m

FOR SALE—300 BOXES IC AND IX 20" x 28" Prime Tinplates. These plates can be bought below present market prices. The Schultz Mfg. Co., Limited, Hamilton, Canada. (c22m)

FOR SALE—TWO No. 210 AND ONE No. 190 Brown & Boggs Punch Presses in good condition. Price $400 each f.o.b. cars. Write or call. Canada Metal Co., 35 Fraser Ave., Toronto. c25m

FOR SALE—1—7' x 100' ROTARY KILN—½" shell in good condition. Immediate shipment. Price reasonable. Location, Ontario, Canada. Address Box 525, Canadian Machinery. (c22m)

FOR SALE—TWO NILES RAIL AND FROG miller, 4-spindle drilling machines. Two Newton cold saws, No. 501 and two No. 502. Also frog and switch planers. J. L. Neilson & Co., Winnipeg, Man. (c23m)

FOR SALE—1—36" x 36" x 12' Bertram Planer, single head in first-class condition. 1—64" x 6' Horizontal Boring Miller, single back geared, in good condition. Globe Engineering Co., Ltd., Hamilton, Ont. ctfm

LATHE FOR SALE—$500, SWINGS 36" OVER saddle; bed, 16' long; double ended; practically two lathes on same bed. Turnbull Elevator Mfg. Co., Toronto. (ctm)

MACHINE SHOP IN TORONTO FOR SALE, in existence for the last fifteen years. Equipment in good condition, plenty of work on hand, making good profits. Will bear strictest and best investigation. Only principals will be considered. Box 517, Canadian Machinery. c22m

FOR SALE—RACINE POWER SAW IN GOOD condition. 12" frame. $75.00 each for quick sale. Canada Metal Co., Ltd., 35 Fraser Ave., Toronto. (c25m)

8—800 AMPERE "SHAWMUT" KNIFE BLADE fuses for 250-volt D.C. current. 2—6" Walworth gate valves, O.S. & Y., bolted bonnet, flange ends. 1—65 H.P., 60-cycle, 3-phase, 550-volt, 1,200 r.p.m. induction motor. Box 620, New Glasgow, N.S. (c24m)

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CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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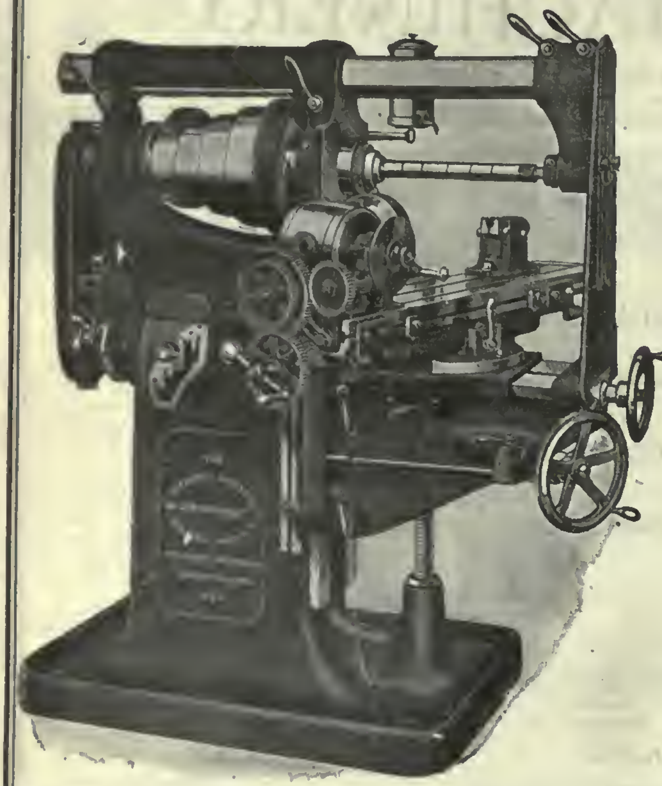

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XX. No. 23. December 5, 1918

Principles and Practice of Mechanical Drawing

In Article Seven the Author Takes Up Conventions Relating to Gear Drawing, Assembly Drawings, Detail Drawings and Abbreviations

By TERRELL CROFT

THE drawing of gears is relatively simple as compared with the process of designing them. It is beyond the scope of this discussion to consider gear design. Hence, only the methods of showing a gear which has been designed will be treated. Many men, who are capable of correctly designing gears, are not familiar with the accepted practices in their representation. That is, they do not know which views should be shown and do not understand the correct methods of dimensioning. The practices, which are illustrated and described here, are typical of those now being followed generally by the most progressive concerns.

Spur gears can be shown by very simple drawings (Fig. 1) where the teeth are to be cut on a milling machine or gear shaper. It is not necessary to show the teeth in detail where they are to be machined by one of the methods just mentioned. The contour and spacing of the teeth are determined by the setting of the machine tool. The "pitch" required should, of course, be shown on the drawing, so that the machinist may adjust the tool accordingly. On the drawing (Fig. 1) it is necessary to show only the depth of the teeth. This may be done in the sectional view, as suggested in the picture, by sectioning up to the base of the teeth. In other words, the gear "drawing" for the smaller gears shows only the blank from which the finished gear is ultimately cut. The completed drawing should set forth the necessary dimensions, so that it will not be necessary for the machinist to do any figuring when cutting the gear. By following this practice time and money will be saved. On the drawing should be specified the number of teeth, pitch, and the pitch diameter.

Bevel gear drawings usually appear about as shown in Fig. 2, which indicates the dimensions and details commonly required. Two views—a section and a half-elevation—usually specify the part completely. Note that for a bevel gear it is necessary that the angles of the cuts be specified. As with spur gears, the number of teeth, the pitch and the pitch diameter should be indicated on the drawing.

Drawings of large spur or bevel gears, for which the teeth are molded rough, should show the outline of the teeth for the information of the pattern-maker. It is not, however, necessary or desirable that all of the teeth all the way around the circumference of the gear be drawn in detail. It is ample to plot in the exact form of only one or two teeth. The exact curves of these teeth outlines should, for the information of the pattern-maker, be shown in such a way that he can reproduce them accurately. If this is not done, the pattern-maker may employ some approximate method in plotting the teeth outlines, which will not provide the form which is really necessary.

A worm gear (Fig. 3) has curved-face teeth cut in its periphery, into which a worm engages or meshes. As with the gears of the other forms, two views—a section and a half-elevation—are, ordinarily, all that is required to furnish the essential information. The pitch diameter is given at the throat of the gear teeth. That is, it is the smallest possible pitch diameter for the gear in question.

A worm (Fig. 4) is merely a screw

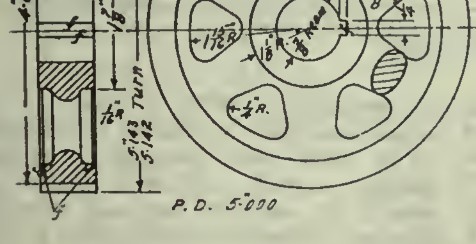


FIG. 1—TYPICAL DETAIL OF DRAWING OF A SPUR GEAR

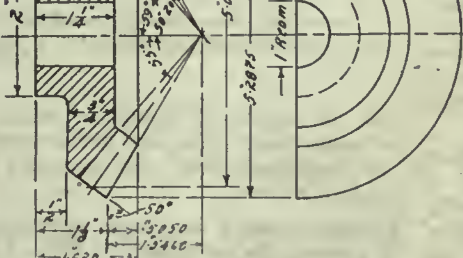


FIG. 2—METHOD OF SHOWING THE DETAILS OF A BEVEL GEAR.

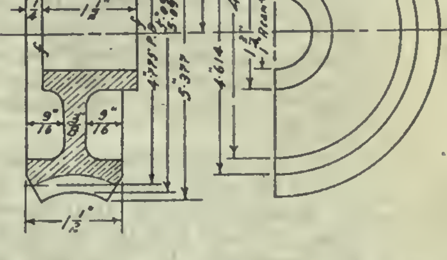


FIG. 3—DETAILS OF A WORM GEAR RENDERED IN ACCORDANCE WITH MODERN PRACTICE.

having threads which are similar to those of the Acme design. This screw has a cylindrical hole bored through it longitudinally in which the shaft which drives, or which is driven by the worm, may engage. The threads are considerably deeper than ordinary Acme threads, but the slope of the sides is the same—namely, 14½ deg. There may be one or more threads on the worm just as there may be a single, double, or triple-threaded screw. Therefore, it should be specified whether the thread required on the worm in question is to be single, double, or triple. Furthermore, it should be shown whether it is to be a right-hand or a left-hand thread. If not otherwise indicated on the drawing, it is ordinarily assumed that the thread is to be single and right-hand, "RH." The lead (Fig. 4) as well as the pitch and pitch diameter should be noted on the sheet.

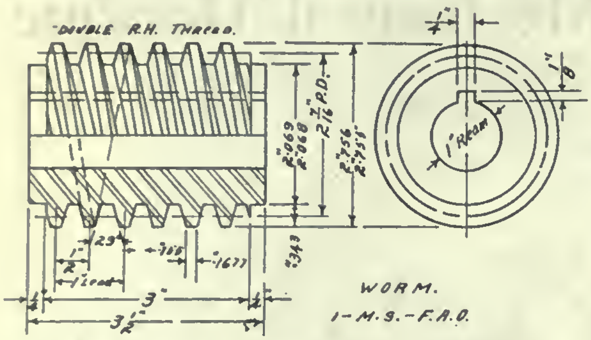


FIG. 4—WORM FOR MESHING IN WORM GEAR.

Assembly and detail drawings are necessary when any object comprising a number of parts is to be reproduced graphically for constructional purposes. Where drawings are made for construction it is, as has been emphasized hereinbefore, essential that the contours, dimensions, finishes, materials, and the like be specified in detail so that the mechanics, who are to construct the device, can proceed with minimum effort It is obvious that it would be impossible to show on one assembly drawing, of even a relatively simple device, all of the information that is necessary for its concrete reproduction. Consider, for example, the oil cup of Fig. 5, which is, comparatively speaking, an uncomplicated thing. Upon consideration it will be apparent that it would be out of the question to indicate the sizes, materials, screw threads, finishes, and the like of each of the component parts on the assembly drawing of Fig. 5. It is, therefore, usually necessary to show the completed object in an "assembly drawing." Then in addition a number of minor drawings showing each of the components separately and specifying them in detail are required. Therefore, it follows that:—

An assembly drawing is one which shows the completed object with all of its parts in place in their correct relation. It shows how the various "details" fit together. An assembly drawing, clearly made and indexed, is of great assistance in economical production.

A detail drawing is one which specifies in detail the construction of one of the component parts of a machine or mechanism, so that the necessary information and dimensions may be given on it, from which the shop man can work.

Sometimes the assembly drawing is made before the details and sometimes after. Which procedure is followed will depend wholly upon the characteristics of the device which is being designed. Frequently, particularly with large complicated machines, it is necessary to first make an assembly drawing which will show the completed contrivance as the designer conceives it. Then, from this plot, each of the component parts is detailed into an individual drawing of its own. The designer may find when he is making the detail drawings that it is desirable to modify the construction which he originated in the assembly. If such is the case the assembly sheet can be rectified accordingly. After all the details have been drawn, they are checked against the assembly, and if the detail drawings and the assembly drawing reconcile with one another, the tracings are then made. On the other hand, it is sometimes more convenient, particularly where the device is a simple one, to sketch in, or draw to scale, the component parts and then combine them into the assembly sheet. Sometimes the preliminary layout is merely a sketch or series of sketches from which the detail drawings are developed and the assembly ultimately made.

The assembly and detail drawings for a grease cup are shown in Figs. 5 to 8, inclusive. Fig. 5 is the assembly in which the different elements are brought together into a completed unit. While this grease cup is, as previously suggested, relatively speaking, a very simple affair, the method of showing it in assembly and in detail is in general the same as one which would be followed in showing any contrivance, no matter how large or complicated. One important principle, which is well followed and illustrated in Fig. 5, is that the assembly should be so rendered that it will show as completely as possible the actual construction and arrangement of the device under consideration. In Fig. 5 this end has been attained by showing the cup partially in section so that the piston, adjusting screw, spring, and screw valve are all exposed. The result is much more effective than if the sectional method of presentation were not adopted. On the detail sheets (Figs. 6, 7 and 8) every item of information is recorded which will be of assistance to the various mechanics—pattern-makers, molders, machinists, foundrymen, and others—in the plant in the completion of their work.

Whether one detail or several should be shown on the same detail sheet is a question the answer for which must also be determined by the conditions affecting the case. Some shops make it a practice to show only one part on a detail sheet. This policy has the advantage that a single detail on a sheet is less confusing to an inexperienced workman than where he must refer to a drawing which contains the specifications for a large number of different parts. On the other hand, the practice of detailing a number of parts on a single sheet has the element of economy in its favor. Both methods are being used successfully. Where a number of details are shown on the same sheet it is usually desirable to locate them in the

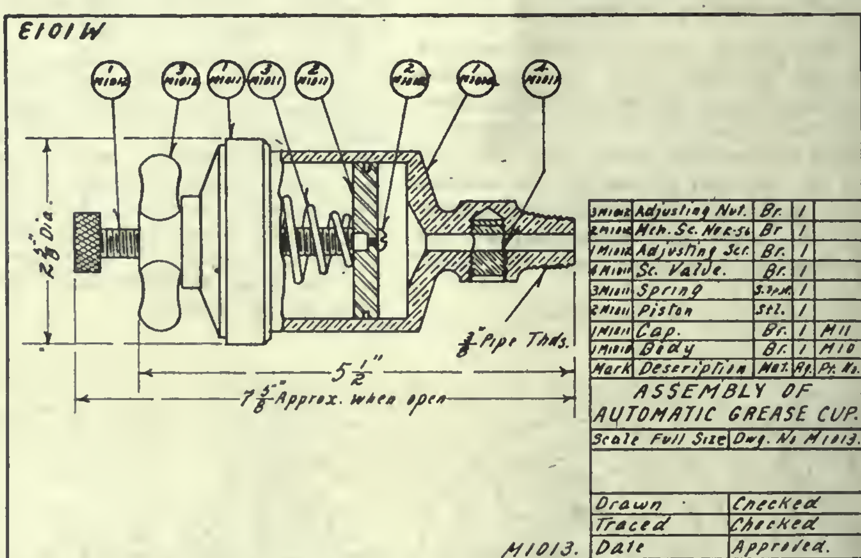


FIG. 5—ASSEMBLY DRAWING OF A GREASE CUP, ILLUSTRATING THE PRINCIPLE AND DETAIL VIEWS.

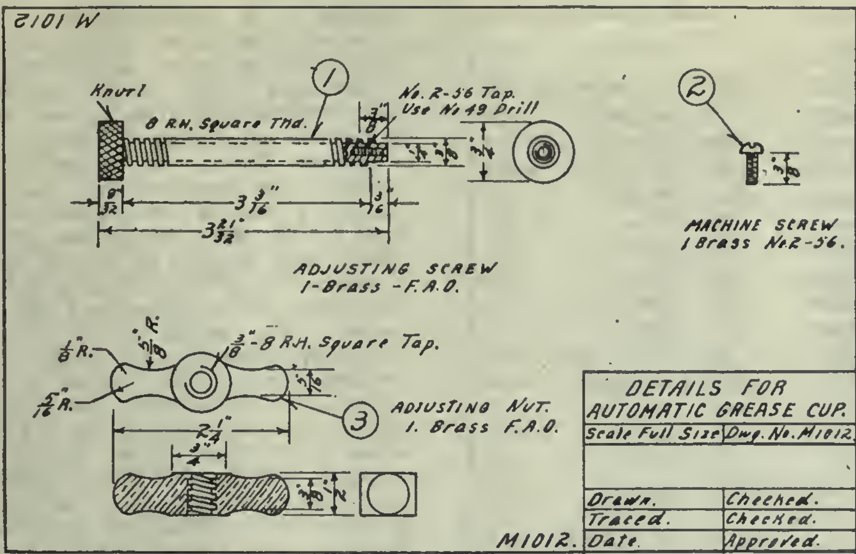


FIG. 6—ADJUSTING SCREW, ADJUSTING NUT AND MACHINE SCREW.

positions relatively to one another which they will occupy in the assembled device.

Methods of indexing the parts on an assembly drawing are many. However, that which is illustrated in Figs. 5 to 8 is adequate and satisfactory for the average condition. The indexing system consists of the index table above the drawing title on the assembly sheet (Fig. 5) and the circles in which are indicated the parts and detail drawing numbers. The index table on the assembly sheet gives the name, the part number, the material, the pattern number, and the number of each required for all of the details. To tie in with this index, each component must be assigned a number. Thus the number for each part is shown within a circle from which a leader extends to the part. Also within the circle is the sheet number, which gives the detail drawing of the part in question. The upper and smaller number in each circle is the part numober, and the lower number is the detail drawing number. Where only one detail is shown on a sheet, as for example, in Fig. 8, where the number M1010 is shown, the detail drawing number is sometimes considered as providing sufficient identification without the addition of the part number. But where several parts are detailed on the same sheet, as in Figs. 6 and 7, then it is absolutely essential that the different parts be assigned numbers, such as 1, 2, 3, etc., etc. These numbers, together with the detail sheet number, will prevent confusion. Always commence the series on each sheet with the figure "1." This insures that a part may be located regardless of name if its part number and the number of the sheet are known. The part number is always placed within a circle near the object to which it refers so it will catch the eye readily.

Abbreviations should, insofar as is feasible, be standardized. For some purposes abbreviations are necessary and desirable. On the other hand, it is a mistaken policy to use too many different ones on drawings. The reason is that where many are used the mechanics must have exceedingly elastic memories to retain them, and as a consequence, confusion and errors may result. As an example of a necessary abbreviation may be cited "F.A.O.", meaning "Finish All Over." This symbol is used so frequently that it would be a waste of time to spell it out always. All mechanics understand its meaning. Again, it is usually desirable to abbreviate the names of the different constructional materials so that the symbols representing them will occupy minimum space in the part index on the assembly sheet. Unfortunately, it appears that every drafting organization, plant, or factory has its own set of abbreviations. No generally accepted list of standard abbreviations is, insofar as we are aware, available. The result is general confusion. The drawings of one concern can not be interpreted quickly and accurately by the members of the organization of another concern, which may desire to do business with the first.

The list of abbreviations shown in Fig. 9 has been carefully selected after studying the practices of a number of progressive concerns. This list is about as long as one as should be adopted

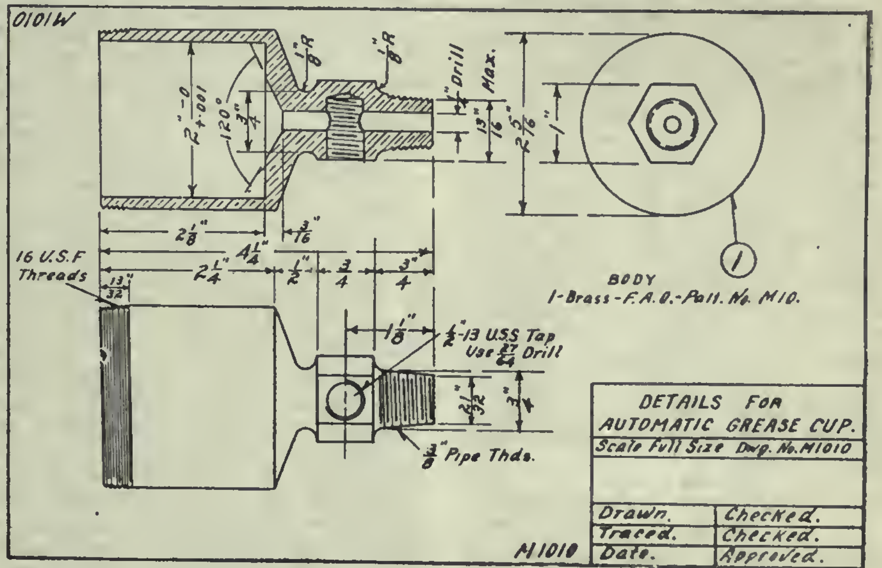


FIG. 8—DETAILS OF THE GREASE CUP BODY

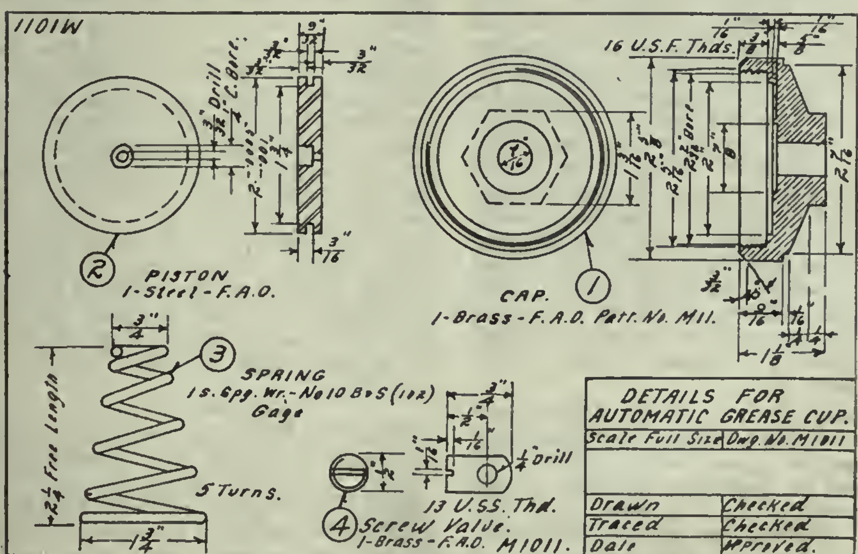


FIG. 7—PISTON CAP, SPRING AND SCREW VALVE.

ABBREVIATIONS.

Aluminum	Al.	Feet	ft.	Machine	Mch.	Refer, Reference	Ref.
Alternating Current	A.C.	Fiber	Fbr.	Malleable	M.	Round	Rd.
Asbestos	Asb.	Figure	Fig.	Manganese	Mngs.	Rubber	Rub.
Babbitt	Bb.	Fillister	Fil	Maximum	Max	Safety Set Screw	SSSc.
Brass	Br.	Finish	f. or Fin.	Mechanics	Mech.	Screw	Sc.
Bronze	Brz.	Finish All Over	F.A.O.	Medium	Med.	Sheet	Sh
Bushing	Bush.	Forging	Frg	Material	Mat.	Sketch	Sk.
Cast	C.	Galvanized	Galv.	Minimum	Min.	Spring	Spg.
Copper	Cop.	Gauge	Ga	Number	No.	Square	Sq.
Corrugated	Corr.	Gloss	Gl.	Octagon	Oct.	Steel	S
Countersink	Csk	Hard	Hrd.	Ounce	oz	Structural	Str.
Counterbore	C'bore	Head	Hd.	Patent	Pat.	Threads	Thds.
Degrees	° or deg.	Headless	Hdlss.	Pattern	Patt.	Tool	T.
Diameter	Dia.	Hexagon	Hex.	Phosphor	Ph.	Washer	Wshr.
Direct Current	D.C	Inches	ins.	Point	Pt.	Wire	Wr.
Drawing	Dwg.	Iron	I.	Porcelain	Prcln.	Wood	Wd.
Estimate	Est.	Kilowatt	K.W.	Pound	#	Wrought	W.
Example	Ex.	Lead	Ld.	Radius	Rad. or R.	Yellow Pine	Y. P.

FIG. 9—TABLE SHOWING LIST OF APPROVED ABBREVIATIONS.

for general use. There are many other abbreviations which are in use, but they are, in general, of special character. They relate usually to some particular industry or have been adopted by some local drafting office to satisfy its own requirements. Where a saving of considerable time is the result abbreviations of special application may be added to the list of Fig. 9 for one's own use. However, before this is done consideration should always be given to the question of whether or not the new abbreviation will conflict with one of the old ones, and whether or not it will tend to confuse, rather than to assist, some outsider. It is always good practice to spell out, in full, on sheets which will go outside of the concern, any group of words the abbreviation for which might tend to confuse.

FULL-SIZED SHIP EXPERIMENTS

By M. M.

Numerous cases are on record where good results have been obtained by alterations made to full-sized ships after they have been completed. Trial trips have been run both before and after the alterations, and in this way a trustworthy estimate has been made of the difference in performance.

At the spring meetings of the Naval architects in 1917, Sir E. Tennyson d'Eyncourt, for instance, recalled the case of two ships built about 17 years ago. After they had been in service for some time he suggested that the bossing, which was nearly horizontal, was not at a suitable angle. On one of the ships coming back to the works it was, therefore, decided to alter the angle to something approaching 45 deg., and in addition, the casting was fined at the aft end as well as the lines of the bossing itself. At higher speeds much better results were obtained than with the old horizontal bossing, but the improvement did not maintain itself at lower speeds. This showed that the improvement was due to the angle of the lines. After the ship had been on service for some time it was found that so much coal had been saved, that her sister-ship was sent to have a similar alteration made to her bossing.

Sir Archibald Denny, at the North-East Coast Institution of Engineers and Shipbuilders, in November, 1915, instanced a rather curious case of alterations made to a full-sized ship, where it was found that the bad performance of the vessel was not due to the suspected cause, but to something entirely different. When the vessel was built, her bilge keels, which were very long, were not put on normal to the bilge, as they would have gone out of water at the ends, the angle of the diagonal plane of the keel being reduced. When the vessel was tried on the measured mile, her efficiency was found to be very low. Someone suggested that the bilge keels were the cause of the trouble, and a length of 20 feet was cut off from each end of both of them. This causing no appreciable difference, the bilge keels were taken off altogether, and the reduction in the resistance was found as nearly as possible to be quite normal. Later it was seen that there was a lack of surface in the propellers, and when new propellers were put on, the efficiency came up to expectations. This, however, did not explain the fact that in an almost identical ship with similar propellers, proper results have been obtained, and Sir Archibald Denny has stated that to this day he is not able to explain with certainty why the results were so different. Another case quoted by him was that of a Channel steamer. In order to get the maximum result, mastic was placed behind each butt and washed off into the general surface, and this was done for some years. But when the mastic cracked off it was not replaced, because there was no apparent differences in the speed on service with or without it.

Admiral Taylor, in his "Speed and Power of Ships," refers to the steamer Niagara, as a yacht about 250 ft. long, in which the shaft brackets were nearly horizontal. She was given two six-hours' trials under similar conditions. In the first, the screws were inward-turning, and in the second were inter-changed to be outward-turning. The horse-power developed on each trial was very nearly the same, but with the inward-turning screws, the average speed was 12.8 knots, whereas it was 14.12 knots with outward-turning screws.

Captain Dyson, the propeller designer to the American navy, has instanced a case of two oil-fuel barges built for the Navy Department. These vessels were designed for a speed of six knots, and everything indicated that the speed could be easily obtained with the power. After trying several different propellers, however, the highest speed realized was only 5¼ knots. It was thought that the action of the water indicated that a portion of the feed was being drawn from astern, and as the cheapest remedy, the line of shafting was changed so as to lower the propeller about 3 ft., although the lower blade projected below the line of keel. In this new position, with propellers of the same pitch and surface, but of 5 in. greater diameter, a speed of 6¼ knots was obtained with the same power as before. The greater portion of this increase in efficiency of the propeller was due to increase in diameter, and the remainder to the change in position, but the increase in diameter was rendered possible by the lowering of the shaft.

Many other examples could be given, but those mentioned are sufficient to show the benefits that may be derived by making alterations in consequence of careful observations of a ship's behaviour in service. The cost of carrying out the alterations must vary, and in some cases will no doubt amount to a fair figure. On the other hand, the large saving brought about by the reduced fuel consumption, which operates during the whole lifetime of a ship, will more than balance even a considerable outlay on such alterations. When it is generally realized, it can be confidently stated that enromous economies will be effected in ship propulsion.

WHY IRON CHIMNEYS CORRODE

The cause of corrosion of galvanized-iron extensions to chimneys is laid generally to condensation, which forms inside the stack, and which, in conjunction with the carbon, which has been deposited in use, creates a galvanic action, which soon destroys the zinc coating, and finally eats through the iron or steel base. The prevent the condensation, an air space around the stack is recommended. The stack is made double from the base to a point close to the top, with small iron braces between the inner and outer castings. These may be riveted close to the ends of the sheets in course of construction. The air space may be one or two inches, according to the size of the smokestack and local conditions. —M. E.

A Handley-Page airplane took up forty passengers the other day, according to London copyright dispatch to the "World." This giant bombing machine, which is the biggest in the world, weighs six tons, and a total weight when fully loaded of 15 tons.

The Training of Engineering Apprentices

Necessity of Training—Standard of Elementary Education Required—The Apprentice From the Employer's Point of View—A Suggested Course of Training—An Apprentice Club in Scotch Engineering Works

By T. H. FENNER, Associate Editor

THE happy turn of the world's wheel that brought in sight the end of war, has concurrently turned men's minds to the vista of peace, with its obligations and rewards. With reference to this an important announcement was made recently by a minister of the Government, concerning the efforts the Canadian Government is about to make, or is making, to provide a merchant fleet. Thirty-one steamers, varying from 4,000 to 10,000 tons, are to be built in Canada, and presumably all the boilers, engines, etc., will also be built in Canada. This is an auspicious event, coming, as it does, at a period when the emergency work of the new Canadian industry was about all over, and the immediate future a matter of doubt. There is every prospect that we shall have a permanent shipbuilding and marine engineering industry, and now is the time to look to securing the supply of men to keep it going. The professions intimately connected with shipbuilding are of the naval architect and the marine engineer. The trades connected with it are legion, some of them highly skilled, some less so. The naval architect is purely a highly technical personage, connected only with the more complicated features of ship design, stability, etc. With him we are not concerned in this article. Neither need we here consider the plumber, steamfitter, electrician, plater, riveter, joiner, carpenter, etc. These are all trades that are in much request in ship construction, but they are trades, and can never be professions. The marine engineer, unlike these, has it entirely within his own power to remain a tradesman or become a professional man. I say, entirely within himself, but that is not strictly correct. It could be more truly put if I say, according to the opportunities afforded him in his apprenticeship days, coupled with his own ambition. Canada has not in the past resorted very much to the apprenticeship system to produce tradesmen, and it may be said that she has not produced tradesmen to any great extent. If marine engine building is to grow to a real industry, then marine engine builders must be trained to enable them to build engines in competition with nations who have a supply of expert tradesmen always on hand. This training must be got systematically, over a sufficient number of years, and under conditions that will enable the neophyte to register a steady progress. During this time his technical education can be looked after and arranged according to capacity shown, so that at the end of his apprenticeship it is quite plain as to whether a tradesman or an engineer has been developed. The question of the best way of achieving these results has been the theme of much discussion, especially in Great Britain, where the apprenticeship system is very fully developed. There has been much difference of opinion expressed among the men at the head of the marine engineering profession, and it must be remembered that these men are the products of the apprenticeship system, sometimes coupled with a university course, but just as often with technical education obtained in evening classes. In this country the big railway shops have developed a system of training apprentices on railway work, and giving them some technical education at the same time, which is a step in the right direction, but naturally, these boys are developed chiefly for railway practice, to become locomotive experts, qualified to be superintendents of motive power, etc.

Standard of Education Necessary

In the first place, before a boy is admitted to an apprenticeship at all, some recognized standard of education should be required. A boy who has attained the age of 16, which he should have before entering the engineering profession, without having a thorough grounding in arithmetic, including algebra, up to quadratic equations, and a good grounding in geometry, coupled with the ability to speak and write good English, is handicapped in the beginning. He is not handicapped in so far as becoming a tradesman goes, but he has a lot of leeway to make up if he is going to become an engineer. The reader may think that a good deal of stress is laid on the terms tradesman and engineer, but this is really necessary, as there is a tendency in Canada to include in the term of engineer everyone from the man in charge of a fried potato cart to the designer of the Quebec bridge. A marine engineer, in the strict sense of the term, is a man who can design, build, and operate a marine power plant, and in virtue of these attainments he is a mechanical engineer. A man who, as is often the case here, graduates to a position in charge of engines through the stoke hold, greasing, etc., is not an engineer. He may be competent to exercise supervision over a set of engines in the same sense that a locomotive driver does, but of the principles and underlying science that those engines are constructed from, he is unaware. This is not his fault, as he has never had the opportunity to acquire such knowledge, and too often, not the elementary education necessary to grasp the opportunity had it presented itself. The same man, if taken from his engine room and put in an erecting or fitting shop, would be of no use except as a laborer, as he has never learnt the trade. Yet he rejoices in the name of a marine engineer.

The Apprentice From the Employer's Standpoint

In discussing the question of apprentices, it is often considered merely from the view of the future prospects of the boy, the firm he is apprenticed to being considered only as a means to an end. Too often the boy himself gets the view, which is bad for him and for the firm. While most employers are only too glad to help apprentices along and offer them opportunities for acquiring the technical side of their work, they cannot be expected to form a secondary education body, which pays for the privilege of teaching. In direct opposition to this idea, many engineering firms in the United Kingdom only took apprentice engineers on payment of a heavy premium, and in return undertook to educate them in their profession. Their other apprentices were apprenticed to fitting, turning, pattern making, as the case might be, but were distinctly tradesmen. This is the supply that the country had to draw from for its working forces. Some of these boys, by industrious application in their own time to technical classes, became qualified for better positions, and some of them rise to high positions. However, it was strictly their own effort. It must be always borne in mind that an apprentice is a source of expense to his employer for the first two years, no matter how good he may be, or how anxious to learn. When he has been three years, the employer begins to get some return from him. After his five years are completed, he usually leaves to get experience of some other shop, or more money, so that any expense put into his training by the employer does not come back to them direct. However, they get the benefit of a continuous supply of labor, which is necessary for carrying on business. There is another benefit in that every apprentice who leaves a shop and becomes a successful engineer, is a perpetual advertisement to that shop, and bearing, as he usually does, an affectionate remembrance of the place where he learnt his business, will reciprocate by placing business their way whenever possible. It may be accepted that, in the larger sense, it is well worth while for the employer to make an effort to encourage his apprentices to acquire knowledge, and to pick out the best according to ability shown, to become eligible for staff positions. A standardized system for all shops would go a long way to help in this effort.

Suggested Course of Training

As a general rule, marine engineering apprentices have always in view, spending some period of their lives at sea, and qualifying for the certificates of the Board of Trade. Probably 75 per cent. of them do actually go to sea for a varying period, according to how the life strikes them, or to their ability to pass the examinations. A considerable number choose this as their life's work, and remain at sea, rising in their profession till they are chief engineer of a large ship. There is no finer class of man afloat or ashore than the marine engineer, and he is generally a well-informed man technically, besides possessing marked mechanical ability and a profound knowledge of boilers, engines, pumps, under hard working conditions, coupled with a perfect knowledge of their construction. Other men, after a few years at sea, enter the service of Lloyd's or the Board of Trade, as surveyors, a position they are well qualified for.

Superintendent engineers of steamship lines, works managers, consulting engineers, are all positions open to the marine engineer who is ambitious. It is, therefore, necessary that the apprenticeship period should cover enough time in the shop itself to allow a thorough grasp of the elements of the trade to be obtained, as well as to have the necessary shop service to qualify for the Board of Trade examinations. The Canadian Government examinations are modelled on those of the Board of Trade, and the Board of Trade certificate is valid all over the Empire. It is on the question of technical instruction during the period of apprenticeship that the differences of opinion are felt. The opponents of the evening technical class method hold that a boy of 16 to 21, who has worked hard all day, is in no fit condition to receive instruction in difficult technical subjects at night. They hold that technical instruction should be imparted during the day. The upholders of the evening class claim that to give technical education during the ordinary working hours, means disorganizing the work of the shop, and prevents the boys getting the class of work they would wish. This is because the best jobs cannot be left standing while the boys attend classes. For those boys whose parents have the means, the ideal way would be to attend the university courses while in session, and devote the remaining time to the shop. The boy following this plan does not become an expert tradesman, but after all, why should he? As long as he acquires the knowledge of how a thing should be done, and the best way of doing it, that is what he will require to round out the technical knowledge required from his university course. Most of the boys following this course of training are destined for staff appointments, and that is what their training fits them for. To come back to our average boy, what is the best course to pursue to benefit himself, his employer, and produce the best men for the engineering trade and profession? If the boy comes to his apprenticeship with the educational acquirements referred to earlier in this article, the necessity for some of the classes attended in the first two years is eliminated. In fact, classes to teach elementary mathematics should not be required in an evening school, as every boy should be kept at school till he has received that instruction. Therefore, let the first year in the shop be devoted to, say three months in the tool stores, getting familiar with the various tools in use before going out in the shops to use them, and the remainder of the time in the fitting shop. The evening class should be confined to acquiring the elementary course in machine construction and drawing. In a shop employing enough apprentices there will be some one man in charge of them, and looking


FIG. 1—READING ROOM AND LIBRARY


FIG. 2—A CORNER OF THE STUDY


FIG. 3—RECREATION ROOM


FIG. 4—GYMNASIUM

after their welfare. If not, the boy's immediate foreman may be depended on to observe his progress. By this time he will have become sufficiently acquainted with the use of his tools to be entrusted with small jobs, and what he has learned at his drawing class will give him an intelligent interest in what he is doing. The second year should be still in the fitting shop, and the evening class work extended to take in trigonometry in addition to the second year machine construction and drawing. At the end of the second year his capabilities as reported by the foreman, and the results achieved in his evening class, should be such as to entitle him to a period on the marking off table, where his knowledge of reading drawings can be put to practical account. This marking off table work is excellent training. After three to six months of this work he should be moved to the erecting shop, where he will combine his knowledge of fitting, with his ability to understand a drawing, in the fitting up of the completed article. His evening classes during this year should include the study of physics relating to the heat engine. At the end of the third year an examination should be held by the firm, covering all the shop experience and technical education received up to date. If the candidate shows sufficiently well in this, he should be admitted to the drawing office, and during the next two years should be given the opportunity to attend advanced technical courses in the day time, either held on the firm's premises, or at the local university or technical college. During this time he will have occasion to visit ships under construction, and under repair, and his knowledge will enable him to grasp the essence of what he sees. At the end of his apprenticeship, if he elects to stay awhile with the firm, they will have a useful man. If, as is most likely, he moves to another firm, or takes a few years' seagoing experience, he has the necessary equipment to become a success. For the boy who does not qualify there still remains a chance. He should pursue his technical studies in the evening, and his shop work will be according to what he shows himself good for. At the end of his fourth year he may be given another opportunity to enter the drawing office. That would still give him a year, and a very useful year. If he does not succeed then, he has still the technical schools to go to. At the end of his apprenticeship he will be, in most cases, an excellent tradesman, with a fair technical education. He may go to sea and become a first class man. He may elect to remain at his trade ashore and work up to a general foreman or superintendent. The fact of him not passing the examination does not condemn him, but merely ensures that the boys of real ability will get their chance. At the least, he becomes a tradesman capable of earning a comfortable living, and by his skill and ability in this direction, helping on the industry of the country.

In connection with this subject the accompanying illustrations show what is being done in Great Britain to encourage the boys to be interested in their work. The recreation rooms shown here are in the works of Scott's Shipbuilding and Engineering Co., Greenoch. The fee for membership in the club is one shilling or 25 cents per annum. It is open every evening except Sundays, and the proceeds of the subscriptions are presented annually to the local infirmary in the name of the club. One of the staff is present every evening to assist any boys who wish to study their homework connected with their technical classes, and there is also a physical instructor in the gymnasium. There is a corner containing lathes, etc., and any boy who wants to pursue a hobby is allowed the use of these tools and scrap pieces from yard and foundry are furnished them to practise on.

A 17-FT. CAST IRON FLY WHEEL

By F. C. P.

The accompanying illustration shows a 17-ft. cast iron fly wheel for an electric motor driven rolling mill as constructed at the West Homestead Mesta Works near Pittsburgh, Pa. This speci-

17-FT. CAST IRON FLYWHEEL

ally designed fly wheel, running two miles per minute is made of cast iron sections bolted together as indicated in the photograph. As it runs at a rim speed of 10,000 feet per minute, the wheel is made of air furnace cast iron, which has a much higher tensile strength than ordinary cupola iron to withstand the forces of this high speed.

THE RELATION OF AVIATION TO SHIPPING

Without merchant shipping it would be impossible to carry overseas commerce. Our overseas commerce will be vastly improved by the addition of aviation. Within a very short space of time after the war we shall find all the principal mail liners fitted with seaplanes. Considerable time will be saved in the transit of mails.

A liner leaving New York with urgent and important letters will be able to discharge them by seaplane, 300 to 400 miles west of the Irish coast; within a few hours they can be delivered in London, thus effecting a saving in time of 24 hours. The same procedure can be carried out by a vessel bound to New York—weather, of course, being an important factor—for in fine and settled weather a well-equipped plane would travel at an enormous speed over a considerable distance. It is quite within the bounds of possibility that letters posted in London can be delivered in New York within four days.

At the outset of this service, which will, no doubt, be subsidized by the governments of both countries, a special charge, say, of 2s. 6d. to 5s. per letter could be made on all trans-Atlantic communications marked "Urgent. Per Aerial Post."

The splendid liners of the Royal Mail Steam Packet Company will in all probability carry seaplanes for the rapid dispatch of the South American mails. Letters posted in Santiago de Chile, via Buenos Aires, could be put on board Royal Mail Steam Packet, and discharged by plane 300 miles south-west of Gibraltar or Lisbon, then transferred to the Transcontinental Aerial Mail. In the same way, London letters marked urgent could be discharged 300 miles north-east of Buenos Aires.

P. and O. liners would find the seaplane of great value in accelerating the delivery of mails to and from the East. The flat island of Perim, known to mariners as the "cinder heap," would make an admirable landing for planes—letters to Europe could then be transferred to another plane and delivered at Port Said. From there they could be reshipped to the Mediterranean aerial mail.

There are four-engined flying machines capable of developing close upon 800 horsepower, flying at a speed of over 160 miles an hour, and soaring to a height of 27,000 feet.

Wireless telegraphy will take an important part in the dispatch of these rapid mail services. The time of the seaplane leaving a vessel and its progress in flight can be transmitted to the position of its destination.

The amazing manner in which the modern aeroplane has increased man's mobility is shown by the fact that a pilot breakfasted in Newcastle, lunched on the south coast, had tea in France, and dined in London.

At the termination of hostilities, thousands of seaplanes will be liberated for commercial purposes—they, and many more, will be required for mail services throughout the Empire.

Nearly 5,000 workmen earning $57 to $60 a week on government construction in Brooklyn, N.Y., have gone on strike and refuse to return unless the order issued by Secretary of War Baker, cutting off all overtime and pay-and-a-half for Sunday work is revoked.

Testing Machines in Industrial Laboratories

The Wise Purchasing of Engineering Materials is Dependent Upon Specifications Properly Controlled by Analysis and Test

By H. S. PRIMROSE, Messrs. Crittal Mfg. Co.,
and J. S. GLEN PRIMROSE, Messrs. Ransomes & Napier, Ltd.

AT no previous time have engineering firms been called upon to do so much physical testing as now to ascertain the suitability of their products, and the privilege has not been given to many of finding themselves efficiently equipped and staffed to undertake the work in their own laboratory or testing department. It has been the great privilege of the writers to be associated for some time past with firms of which the managing directors have been sufficiently broadminded to assist their neighbors in the making of tests, and they venture to claim that not only is this action much appreciated by those concerned, but that the efficiency of the area has been considerably increased in consequence of the advice secured. The authors take this opportunity of thanking Mr. F. H. Crittall, of Messrs. Crittall Mfg. Co, and Sir Wilfred Stokes, of Messrs. Ransome and Rapier, the managing directors of their respective firms, for permitting them to place before the Institute the firsthand descriptions of the several testing machines employed in their laboratories, and also of some of the interesting data obtained by their use. The prime considerations which caused the selection of most of the machines described were their moderate cost and short time of delivery, and other, but no less important points, were their simplicity and convenience for commercial testing, combined with the accuracy of their determination of the various physical properties of metals. The article is published through the courtesy of "London Engineering."

Tensile Testing Machines

Whilst for a long time we have been almost exclusively confined to the use of lever machines in this country, the use of lever testing machines has been almost entirely abandoned on the Continent, and also to a large extent in America. The hydraulic method of applying the load is nearly universal, but in most cases an independent system of measuring the stress is necessary, and few rely wholly upon the simple pressure-gauge method for accuracy and continued reliability. One class of machine is so designed that the application of the load and its simultaneous measurement is accomplished by the same pressure system, and this, of course, constitutes a very simple, convenient and compact machine, which has no knife edges or springs to go wrong, and is further entirely free from inertia effects which are so fruitful a source of error. This principle is adapted to the vertical form of testing machine by Messrs. Amsler Brothers, of Switzerland, and their combination of press and pendulum gauge is recognized by the Association of Testing Materials as universal; it is constructed in a variety of sizes and standard forms. Their 1916 model of 30-ton universal testing machine is shown in Fig. 1, and this has the various arrangements whereby round, flat and headed test bars may be tested in tension; it enables bending, transverse and compression tests to be performed, and by means of easily adjusted bolsters it permits hardness, shearing, or punching tests to be made with the minimum of trouble.

The entire machine comprises three parts, the first of which is the press with a steel ram operated by compressed oil. The fit in the cylinder is sliding, so that friction is negligible owing to the small constant stream of oil escaping while the machine is at work. The pressure of oil is conveyed from the ram through a cross-head with a hardened steel socket, to two steel bars freely supporting the cradle or moving head. The crown is secured to the base by four stout steel bars which support the superstructure, and these endure the maximum load of the machine without appreciable deformation. The base itself is a hollow iron casting with a steel table to anchor

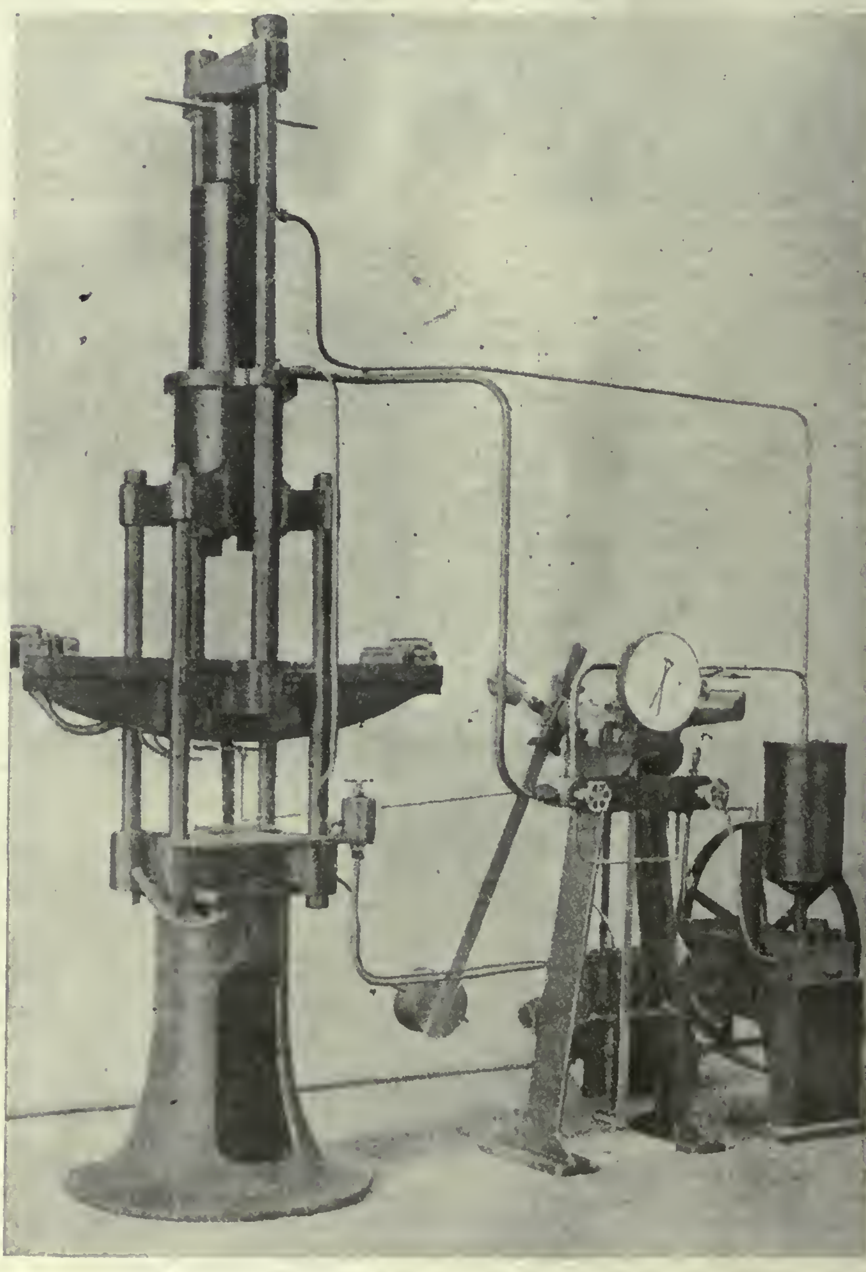


FIG. 1—30-TON AMSLER UNIVERSAL TESTING MACHINE

the wedge grips or other shackles, and no great strength is required in this stand as it supports no part of the loading, nor does it require to take any overhang since the centre of gravity is not moved during the conduct of the tests. Tensile and shearing tests are made by securing the test bars between the base and the cradle, and compression, punching, bending and transverse tests are made between the cradle and the crown without any elaborate fittings. To raise the moving head to any required position the pressure oil is admitted by the valve at the right of the press, and to lower it again by gravity it is sufficient to open the release valve on the pressure gauge, and let the oil return to the reservoir in the pump.

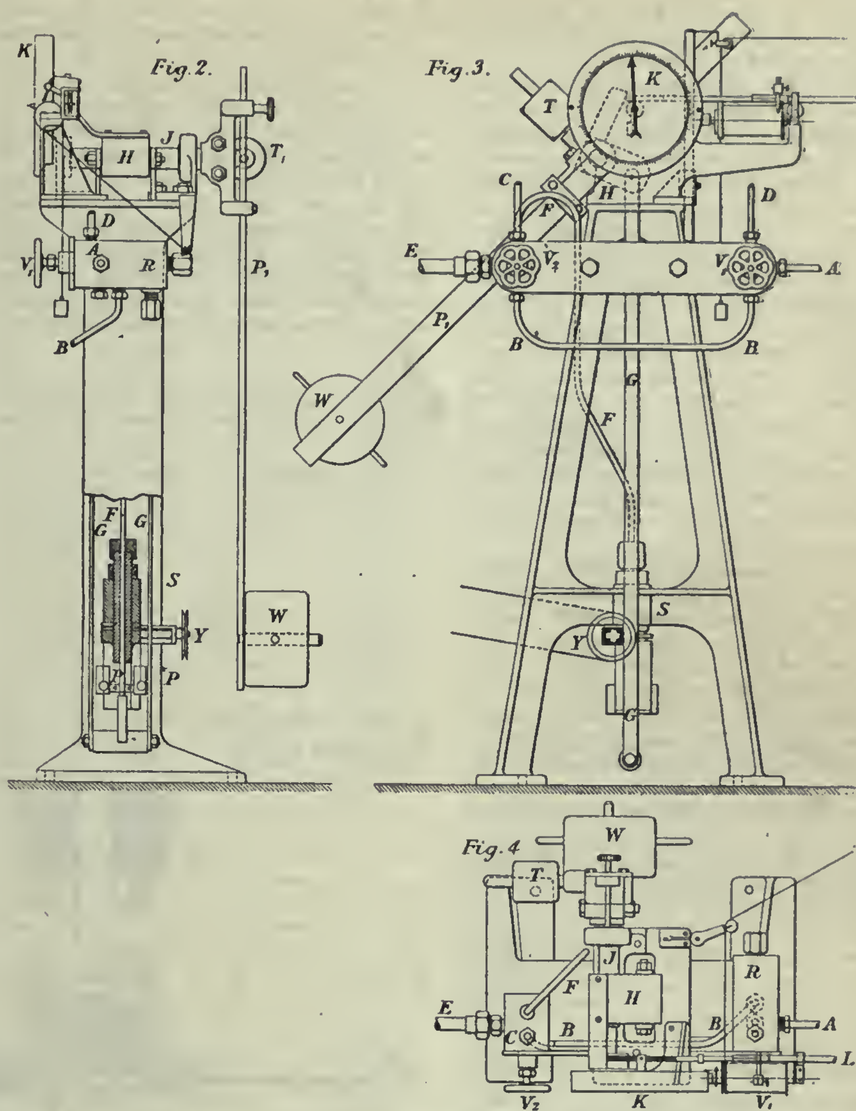
Oil Pump

The high-pressure oil pump is the second part of the apparatus, and it may be driven by either belt or motor. The oil supply is delivered by three pistons at a steady pressure up to 3 atmospheres, and the suction valves are controlled by a handle which lets the motor run light when in the "off" position, but forces oil through the pipes when in the "on" position. If all other valves in the pressure gauge and press are closed, then the oil is simply short-circuited by a spring-controlled valve, back into the reservoir.

The third part of the assembled machine is a simple and accurate form of direct-acting pressure gauge or pendulum manometer, which measures the force exerted on the test piece by the oil pressure. This it does by displacing a freely hung pendulum from the vertical position so that the pointer of the gauge constantly indicates the force exerted by the automatic balance effected by the pendulum. Details of the pressure gauge and regulators are shown in Figs. 2 to 4. Pressure oil enters by pipe A, and may be short-circuited by a spring at the back of the regulator R into the pipe B, and large return pipe C communicating with the oil reservoir. On opening the valve V_1, oil flows by the uptake pipe D to the cylinder of the press, and thus elevates the ram. The release valve V_2 on the left of the manometer puts the pressure pipe E into communication with the return pipe C. When load is placed on the specimen the oil pressure is conveyed by pipe F to the small cylinder S, which causes the piston P to move without friction due to its rotation and the slight escape of oil. The force which expels the piston P is transmitted to the two vertical rods G bolted together by a distance-piece at the bottom, and attached to a short block lever H at the top through ball bearings. The movement of H causes the shaft J, mounted in the manometer frame with ball bearings, to rotate and deflect the pendulum from its normal position till it assumes a position of equilibrium. The pendulum rod can be suspended from several different points, giving a variation in the sensitiveness of the machine.

Record

Sensitive records of the variations in the loading of the test bar are secured in a unique manner. Attached to the front end of the rod J is a short steel arm parallel to the pendulum, and moving against a screwed rod L, which not only actuates the pointer moving over the scales of the dial K, but also carries a sliding pencil holder. The tracing pencil moves over the diagram paper clipped on to the brass drum which rotates smoothly when actuated by the chord from the extensometer attached to the test bar. With short bars it is often sufficient to take the travel of the cradle relative to the base for commercial purposes, and this also saves the removal of the extensometer prior to rupture of the bar. When the bar breaks the pendulum falls back freely for but a short distance, as the oil escaping from the cylinder S has to do so by a small by-pass so that the motion is comparatively slow and without jerk. Although the pressure gauge is so sensitive there are no weak parts in it to go wrong, as it is throughout of the most robust construction, and yet it is not unwieldy. It simply requires to be bolted to the floor sufficiently level to let the pendulum swing in a perfectly vertical plane. The rotation of the screwed rod L, whilst holding the pencil carrier, enables the pointer to be readily adjusted to zero at any time. Measurements on the autograph diagram are facilitated since the complete rotation of the pointer over the scale gives a travel of 10 cm., corresponding to the maximum load for each sensitiveness.



Figs. 2 to 4. Automatic Pendulum Pressure-Gauge used with Amsler Testing Machine.

Other Tests

To make transverse or bending tests, two roller supports are fixed at a convenient distance apart in the cradle by means of the side screws which engage the cross bars sliding in a slot which runs the full length of the cradle on each side. The middle support to apply the bending, is suspended by a pin let into the side of the crown, and this only requires to be withdrawn to let it fit into a slot encircling the head of the support. This may be provided with a roller like the side bolsters, or it may be simply a rounded die to effect the bending test when the supports are moved into close proximity. The centrally-held die may be provided with a spring clip holding a 10 mm. ball to perform Brinell hardness tests when the cradle is raised with the specimen to effect the compression.

Compression tests are very simply made on test pieces placed between two

cylinders, the test-piece can be readily inserted and sheared without any considerable amount of bending such as usually accompanies this test.
hardened steel discs, one of which is held in the middle of the cradle by a square foot-step, and the other is supported from the centre of the crown by a circular bolster provided with a spherical seating to ensure the crushing faces being parallel. Crushing tests are now more commonly specified than formerly, and interesting results are often obtained with metal which have been variously heat-treated and worked, as shown in Table I. The first section shows the toughening effect of oil quenching upon a medium carbon steel for power press screws, the second deals with the forging of ordinary cast-iron between dies in the press, and the third part shows how much even the strongest brass may be improved by mechanical treatment at the right temperature.

For making shearing tests, special yokes are fixed by the cross bolts through the baseplate and the cradle. These two portions are provided with hardened steel cylinders with a hole through each for carrying the test bar. Accurate alignment is secured by screwing up collars at the end, thus preventing any play between the shearing faces. By selecting a test bar diameter nearly equal to the central opening in the hardened

TABLE I—Effect of Mechanical and Heat Treatment on Compression Strengths of Medium Carbon Steel, Cast Iron and Brass.

0.45 Per Cent. Carbon Steel	Compress'n Elastic Limit.	Brinell Hardness Number.
	tons per sq. in.	kg. per sq. mm.
Normal (Long.	47.5	185
" (Trans.	42.5	180
Single oil quenched (Long....	93.8	365
" " (Trans...	92.0	340
Single water quenched (Long.	91.0	340
" " (Trans.	89.5	340
Double oil quenched (Long...	85.3	320
" " (Trans...	82.5	320

Med. Carbon Cast Iron Forged at 850 deg. C.	Ultimate Tensile Strength.	Compression Elastic Limit.	Ultimate Crushing Strength.	Reduction of Length before Cracking.	Brinell Hardness Number.
	tons per sq. in.	tons per sq. in.	tons per sq. in.	%	kg. per sq. mm.
1st Set—Water cooled	12.5	30.2	59.8	26.8	165
2nd Set—Air cooled	11.0	28.8	58.6	23.1	150

Beta Brass for "A" Metal, Forged at 650 deg. C. and Air Cooled.	Ultimate Crushing Strength.	Tensile Tests. Elastic Limit.	Tensile Tests. Ultimate Strength.	Tensile Tests. Elongation on 2 in.	Tensile Tests. Reduction of Area.	Brinell Hardness Number.
	tons per sq. in.	t. per sq. in.	t. per sq. in.	%	%	kg. per sq. mm
1st set.	62.7	22.6	40.2	23.1	22.8	170
2nd set.	61.0	21.2	39.4	21.6	25.0	165
3rd set.	59.8	20.6	39.8	23.1	23.9	165
4th set.	58.0	20.0	38.2	28.4	28.7	160

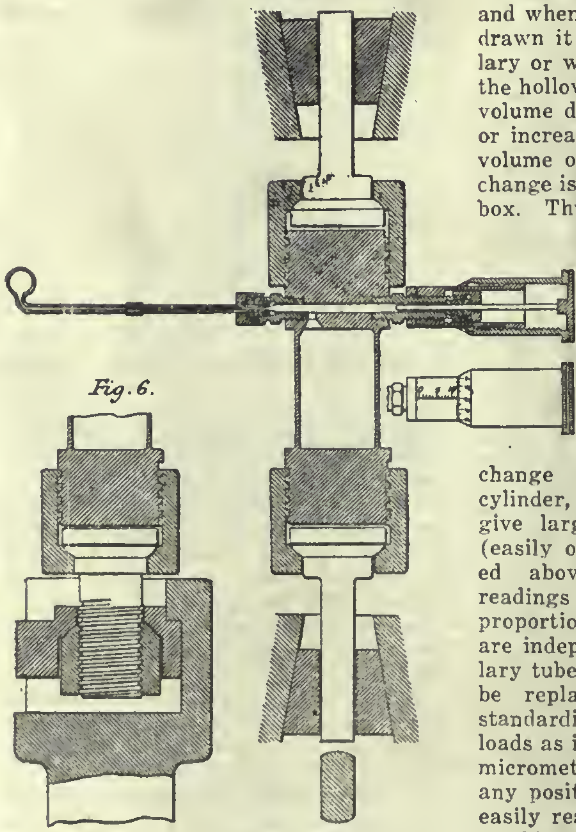
Values given are the average of four tests.

Punching tests also give useful information as to the behaviour of metal under other stresses, and it has even been claimed that this test gives a better average value from which the tensile result may be calculated than the direct tensile test itself, since the latter deals with a much smaller section than that cut by the punch. The punching test as performed in the compression part of the testing machine only requires a simple bolster to carry the punch and die in correct alignment, and to withdraw the punch without displacement of this after the flat test piece has been pierced. Several corresponding values of the ultimate tensile, punching and shear stress of several grades of steel are given in Table II and show that simple relationships can be established between these values.

TABLE II—Relationship of Tensile Strength with Punching and Shear Stresses for Various Steels.

Average Tensile Strength.	Actual Punching Stress.	Shearing Stress.
tons per sq. in.	tons per sq. in.	tons per sq. in.
21.3	18.3	10.1
25.0	19.2	11.8
28.1	21.5	12.9
32.0	23.7	14.3
34.5	25.5	15.2
39.0	28.0	16.8
43.0	30.7	18.0
47.5	34.1	19.6
"T"	0.65 T + 3.18	0.35 T + 3.0

When autographic diagrams are taken of the punching and shearing tests, valuable information is got as to the practical value of the metal, its ductility and behaviour in practice. The yield-point in shear stress is easily observed and serves to place the metal in the class to which it belongs.



FIGS. 5 AND 6—AMSLER STANDARDIZING BOX

Standardizing

Even although it is usual for each testing machine to be securely calibrated by the makers and guaranteed to be correct, it is usually advisable to check them occasionally to ascertain if there is any variation during service. To do this, it is sometimes considered necessary to lift standard weights on the testing machine itself. Otherwise a standard bar of known modulus of elasticity may be submitted to tension within its limit of proportionality, but this necessitates precision instruments to measure the deformation. The crushing of a number of small copper cylinders of known reduction of length for a given load may be adopted, but no very great accuracy may be expected from this method. To overcome these difficulties Messrs. Amsler have invented an ingenious standardizing box which is light and easily handled. It can be used without expert knowledge to check testing machines either in tensile or compressive stress, both quickly and with as great exactness as by the dead-load method.

As shown in section in Figs. 5 and 6, the box consists of a hollow cylinder of special steel filled with mercury which extends into a horizontal capillary glass tube projecting from the box. The tube is provided with a zero mark to which the mercury is adjusted by a micrometer screw, the stem of which projects into the enclosed space filled with mercury, and when the screw is advanced or withdrawn it pushes mercury into the capillary or withdraws it into the box. When the hollow cylinder is stressed axially the volume decreases under the compression or increases under tension so that a volume of mercury equal to this volume change is expelled from or pulled into the box. Thus the micrometer handle must be turned to restore the mercury to the zero point in the capillary tube, the bulb at the end of which holds any excess and prevents its escape. The scale on the micrometer enables the observer to read hundredths of a turn of the handle, and this gives a measure of the change of volume of the steel cylinder, which being thin-walled to give large displacements of mercury (easily observed), must not be stressed above its elastic limit. The readings of the micrometer which are proportional to the loading of the box, are independent of the size of the capillary tube, so that if one is broken it can be replaced by another without restandardizing the instrument by dead loads as is done in the first instance. The micrometer can be turned at pleasure to any position so as to admit of its being easily read when in place in the testing machine. In making compression checks, it is necessary to ensure that the box is placed between two perfectly flat surfaces parallel to one another in the extension boxes for tensile standardizing crown and cradle of the machine. The have screw heads with extension pieces to be gripped either in the wedges or in the spherical seatings of the other shackles. These boxes are made in two forms, one for measuring compression only, and the other for either extension or compression, the former ranging up to 120 tons, the latter up to 30 tons. To convert the double-purpose boxes from tensile to compression use, it is only necessary to screw off the heads of the end extensions. As the constants of the micrometer readings for compression differ slightly from the same stress readings in tension, the two sets of constants are stamped on the boxes.

Torsion Testing Machines

The importance of this useful method of determining the shear strength of metals has been recognized only comparatively recently, and although many forms of lever machines have arrangements for carrying out this test and for measuring the torque, it is still not a common test to be made commercially. Some of these machines have been fully described by Hailstone in vol. xxviii of the Staffordshire Iron and Steel Institute proceedings, but there is a simpler way of measuring the torque than by means of the customary lever. The balancing of the twisting couple produced lends itself readily to the use of the pendulum pressure gauge, and Messrs. Amsler make several types of machine in which this principle is used. The smaller hand size for torsion testing alone is illustrated in Fig. 7, which shows the machine to consist of a rigid frame with two heads, the fixed one for applying the torque, and the other moving on ball bearings and carrying the pendulum. The bar to be tested is screwed in jaws in the two heads, which take flat bars or rounded ones if provided with rectangular heads. The torsion couple is produced by a pulley driven by belt or worked by hand, and the rotation is transmitted to the test bar by worm and wheel. The pendulum, suspended from the moving head by an axis which rotates in ball bearings, serves to balance, by its inclination from the vertical position, the torque developed in the test bar. The weight of the pendulum bob is easily changed by removing parts of it which are bolted on, so that the sensitiveness of the machine can be increased by diminishing the maximum torque from the full 150 kg.-m. (say 1,100 lb.-ft.) to 100 kg.-m. and to 50 kg.-m. The angular displacement of the pendulum in conjunction with the angle of twist of the test bar gives a means of autographically drawing a diagram of the test. The movement of the pendulum-carrying head along the frame of the machine prevents the test bar from being subjected to the slightest tension as it shortens under the twisting it receives.

Messrs. Amsler make combined tension and torsion machines which may be made to exert a tension of 30 tons or 50 tons simultaneously with or separately from a torque of ½ ton-ft. or 1 ton-ft. The tractive force is applied hydraulically by oil under pressure, but the twisting movement is applied by hand through gearing. The base of the machine is not fixed as in the universal machine, but may be moved up or down to the required position along the four supporting rods, by means of a hand screw. The cradle or moving head carries the fixed end for the torsion test, the lower grip in the base being made to revolve centrally. To balance the torque use is made of the oil pressure set up in two cylinders situated horizontally in the crown of the machine. The pistons working in these cylinders act as pumps, and the resulting pressure is conveyed by a pipe to the registering pressure gauge. The tension and the torsion pressure gauges are set on the one stand, side by side, so that they can record their respective diagrams on the same sheet of paper clipped on the drum. Instead of the ordinary pendulum gauge, the manometer used in this instance is usually the laminated spring type. This form of spring manometer is capable of accurately indicating and registering rapid changes in the stress applied. The oil pressure from the cylinders passes by the several tubes to their respective gauges, and by pressing upon a piston moving without friction in a small cylinder, causes two leaves of the laminated springs to be pressed closer together. A fine-toothed rack engages a small pinion in the centre of the indicator dial, and causes the pointer to move round the scale. By attaching different weights to the underside cross-head of the gauge various sensitivenesses can be registered in order to have an open scale for each reading. The balancing of the different stresses exerted on the test bar is thus automatically effected, and it leaves the operator free to perform the complex test, since after he has started the tension force by admitting the pressure oil to the top cylinder, he can give his attention to the application of the twisting couple by hand, the diagrams being autographically produced.

(To be continued)

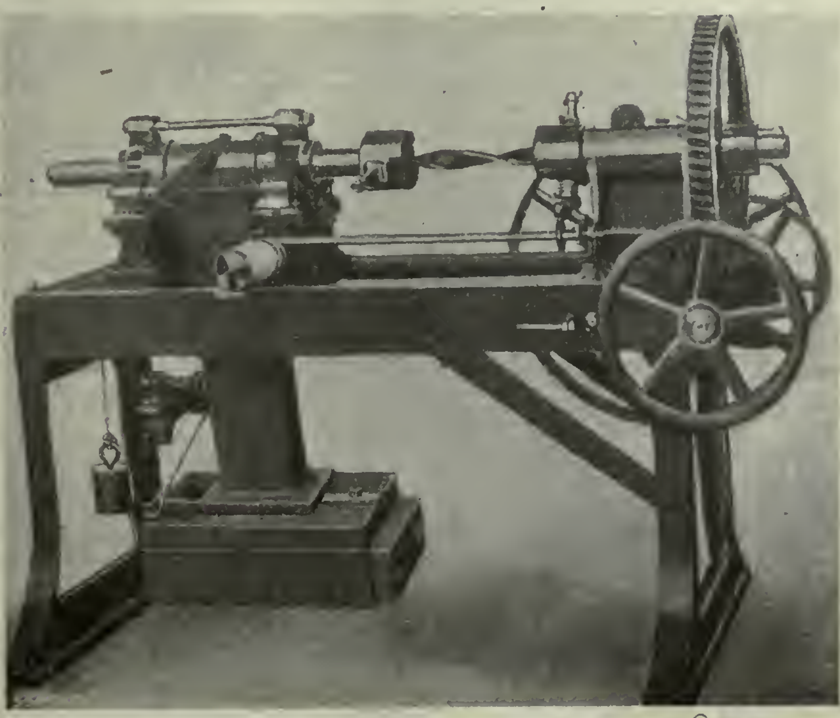


FIG. 7—AMSLER TORSION TESTING MACHINE

DESPISED EVEN BY HUNS

German Prisoners Struck Rather Than Work With Cowards.

A remarkable incident occurred (says the Central News) at a camp in the south of England, where a large number of German prisoners are engaged in making roads. In order to facilitate the progress of the work a number of conscientious objectors were detailed to assist the prisoners. Upon their arrival the German prisoners struck work, and a n.c.o. delegated to speak to the officer in command, said: "We have struck work. These men are conscientious objectors and won't fight for their country, and we won't work with them. Let them go and fight, the cowards." The officer tried to reason with the "delegate," but the latter said it was no use, they could punish him and the others if they liked. Indeed, they would accept any punishment, but they would not work with conscientious objectors. Eventually the C.O.'s were withdrawn, and the strike ended.

A well-known Scottish architect was once travelling in Palestine, when news reached him of an addition to his family circle. The happy father immediately provided himself with water from the Jordan to carry home for the christening of the infant, and returned to Scotland. On the Sunday appointed for the ceremony, he duly presented himself at the church and sought out the beadle, in order to hand over the precious water to his care. He pulled the bottle from his pocket, but the beadle held up a warning hand, and came nearer to whisper: "No the noo, sir," he said, "no the noo. Maybe after the kirk's oot!"

You can't succeed if you don't take pleasure in your work for its own sake. And if you are fitted for it, you will.

WELDING AND CUTTING

The Development of Electric Welding

The Author, in a Paper Read Before the A.I.E.E., Outlines the Present Status of Electric Welding—The Use of Alternating Current—Methods of Electric Welding and Future Developments

By H. A. HORNER

THE two main processes of electric welding, namely, arc welding and spot welding, were found by this committee applied in the first case to repairs and in the second case to certain factory quantity production jobs. The work done was in the case of spot welding only on light material, and in neither case very extensive. The processes to be successful in their application to the construction of merchant vessels would have to show reliability in the joining of steel plates from a half-inch to one inch in thickness. To this and kindred problems the committee immediately turned its attention.

The work had all been done in the field where it had been applied by practical men. It was first necessary to formulate the proper nomenclature and symbols. This was thoroughly investigated and a very comprehensive set of symbols has been approved by the committee and is in daily use by those now actively engaged in this new application. The approved nomenclature introduces the subject to the designing and calculating engineer and gives him the instrument by means of which he is able to place his thoughts rapidly and conveniently on drawings.

The manufacturers of apparatus joined the practical man in the study of the problems of electric welding. Apparatus and so-called processes introduced various types of machines suitable for the conversion of electrical supply to the proper values of current and voltage needed at the arc or at the spot. The manufacturer in his eagerness to meet the problem naturally encountered many difficulties. These difficulties increased until a point was reached as referred to above where he demanded some standards upon which his apparatus could clearly be rated. Therefore, the manufacturer was only too pleased to co-operate with the Welding Committee and is to-day conscientiously aiding in straightening out the difficulties in which he was involved prior to last year.

Arc welding in this country has largely been done in the railroad repair shops. It was discovered that the process was much cheaper and could be performed more rapidly than by any of the gas welding methods. It also could be applied without preheating and in many cases without the expense of disassembling complicated pieces of machinery. Spot welding besides being used in many different industries was sought for by the railroad man and there has been built a gondola car which has seen some seven or eight years of service. It is interesting to note here the difference in practice between Great Britain and the United States. The former knowing little or nothing about spot welding had the practice and application of arc welding very well under way; the latter exactly the reverse.

Apparently the attempts to train operators were rather crude and it was early observed that the reliability of the electric weld depended substantially upon the skill of the welder. The manufacturers of apparatus and the superintendents in railways shops had struggled with the problem of training operators, but intensive study had not been given the subject so that there existed in this respect a great deal of groping in the dark.

Present Status of Electric Welding

Investigations were immediately undertaken to answer the question whether spot welding could be successfully accomplished using one-inch thick steel plates. An experimental apparatus of large size was erected and put into operation, the results showing that no difficulty was encountered with half-inch and three-quarter-inch plates. The same remark applies to one-inch steel plates. In fact, this experimental machine was successful in welding three thicknesses welds of half-inch ship structural steel exceeds the requirements of merchant ship construction. This operation has its historical significance in that this was the first time that any spot welding of this magnitude had been performed. The successful outcome of these experiments has led to the design and construction of large spot welders to be used in the fabrication of ship sections. The practical application of a large five-foot spot welder will be made at a demonstration of a forty-foot section of a standard 9600-ton ship to be built at the plant of the Federal Shipbuilding Company, Kearney, New Jersey. This is the largest portable spot welder ever built. It will prove two points in ship construction by the electric method, namely, the clamping of the ship's structural parts for assembly thereby reducing the time in working the material as well as for the erection of the ship material; and, secondly, by the speed of spot welding it will prove the decrease in time for joining the material together. The consensus of opinion is that the large stationary spot welder of five or six-foot gap will undoubtedly play an important part in increasing the speed of fabricating sections of standard steel vessels. Further investigations are being made and designs are being worked out for special spot welders for use in the construction of bulkheads. The designs proposed are chiefly for shop processes, but it can be asserted that such apparatus will be of undoubted value in the saving of time and man power.

Arc welding had been tried in a great variety of work, but there was no conclusive evidence that it could be developed to the stage of joining ship plates with the certainty of full strength. The first stage of his investigational work is now almost completed. Sample welds of half inch ship structural steel were taken by a special sub-committee to fourteen or fifteen different places where electric welding was done, noted the conditions of current, voltage, electrode, operator, etc., and then prepared the welded samples for tests. The samples were forwarded to the Bureau of Standards in Washington so that the tests should be conducted by parties absolutely disinterested and without knowledge of how the samples were obtained. The results of these tests showed a remarkable similarity especially when it is realized that they were made by several firms with different electrode materials and under varying conditions of the electrical current. Practically all of the welds pulled at over 50,000 pounds per square inch and several over 60,000 pounds, the average being about 58,000. On the bending test one of the samples was bent to an angle of 78 degrees before a crack started and final failure reached 80 degrees. In another case the sample was bent to 65 degrees before the crack started and final failure did not occur until 86 degrees. The point of importance here is that all the welds showed a reliability and satisfactoriness which makes conclusive the opinion that electric arc welding is applicable for the joining of steel where the structure is submitted to live loads, bending strains, static pressure, or the like.

To give a further indication of the large size practical tests which are being carried on at the present time it may be stated that three 12-foot cube electrically welded tanks are now being constructed. These tanks are built in such a way that from twelve to fifteen different designs of joints are used in their construction. After these tanks are built they will be subjected to a static strain and the deflection of the seams will be directly measured. Afterwards they will be tested by external shock and crushed to destruction. Portions of the joints will be cut, sent to the Bureau of Standards, and again tested for the sake of accumulating precise data. In this connection there is being built at the Norfolk Navy Yard a battle-towing target. The keel of the target 110 feet long will be entirely electrically welded and the results of this practical demonstration will be carefully recorded after it has been put in regular service.

Alternating Current Found Advantageous

It is to be expected that the manufacturers of apparatus being keenly observant of the increased interest in electric welding as well as in the future, which is probably now unquestioned, would be active in their desire not only to improve their present facilities and their design of apparatus, but also to proceed themselves to follow the trend of the investigations made by the Welding Committee. The consequence of this has been a large increase in output of apparatus that is needed. One interesting point is that certain manufacturers who were decidedly of the opinion that direct current was the only proper current to use for arc welding have within a very recent period changed their point of view and are willing to admit that alternating current may have certain advantages in the development of this art.

The electric arc requires a reduced voltage and this is difficult to attain with direct current without relatively expensive machines or a useless expenditure of energy. The practice in this country in manufacturing establishments of any size has been toward an increase in the supply voltage so that very few large manufacturing plants use less than 220 volts direct current. With this voltage the only economical method of transformation is in the use of a motor-generator set. The efficiency in this case is in the neighborhood of 50 to 60 per cent. It is possible to use a supply voltage of 110 volts with a variable resistance which cuts down the voltage to the arc volts. This gives a very poor efficiency. In the case of alternating current the supply voltage can be reduced by a transformer which will supply as in the case of direct current a sufficient voltage for striking the arc and a satisfactory reduction when the arc has been struck. On the other hand, if a low voltage alternating current is provided a simple reactance may be introduced which has some of the same wasteful characteristics of the resistance used with the direct current. The average apparatus will permit of electric arc welding consuming about six to eight kilowatts per welder, but if low voltage is provided there are certain outfits which will reduce the consumption as low as three and one-half kilowatts per welder, or even less.

Without entering into an elaborate analysis of the relative cost of electric welding, it may be broadly stated that there is hardly any question that the electric process is cheaper than any other. The same may be said as regards speed and also reduction of man power. In a recent discussion of this subject President Adams stated that at one of the Eastern shipyards the total number of parts on the welding program of the standard riveted ships now building at that yard amounted to 225,000. The labor cost for riveting these pieces is about $245,000 and for welding about $99,000, making a saving of $146,000. But this is only a drop in the bucket when compared to what might be profitably done in this line. He stated further that in certain particular instances the saving is as great as 90 per cent.

One of the interesting questions discussed with some fervor by the members of the Welding Committee is the advantages of the bare and covered electrode. Regarding this discussion no definite facts can be stated. In England the practice has been to use the covered electrode which protects the welding arc from contact with the air thus guarding against too great a formation of oxide. The practice in the United States up to the present time has been largely bare wire. Recently, American investigators have discovered the important fact that there are advantages in the covered electrode and many experiments are now being made, some with results. It is important to observe that in the above mentioned tests of welds, the best one of these samples was made with a coated (not an abestos covered) electrode using alternating current. The point in this case seems to rest upon the question of the dutility of the weld and it would seem that the bare electrode does not make as ductile a weld or at least one as easily bent as the coated or covered electrode. The question of the ductility of the weld is one of much importance in the application to ship construction and will doubtless be of importance to other allied industries. It is, therefore, a question of serious importance and constitutes an important part of the work of the Sub-committee on Research.

No matter what the type of electrode is nor its composition, no matter what kind of shank material is to be welded, no matter what kind of apparatus is employed, the reliability of the weld rests mainly upon the man who welds it. This man if he has been properly trained and is skilled in the art knows instantly whether he is making a weld or not. He becomes after much practice able to judge fairly well upon looking on a finished weld whether it is a good weld or not. The work of training electric welding operators early became a part of the functions of the Education and Training Section of the Emergency Fleet Corporation. The men connected with this work are members of the Welding Committee. Schools for the training of operators as well as for the conversion of operators into instructors, are established in many parts of the country. The objects held in view by the training department are first to give the man intensive practice work so that he becomes a good craftsman. The methods are simple to start with, as the exercise of the right arm muscles must become flexible enough to permit the operator to give the required movement to the electrode. By a graduated series of exercises this is accomplished in about eight weeks. The man is allowed to do production jobs in the shop which gives him confidence through responsibility. It becomes desirable at this time to give the man some outside work on ships and where this is practicable it is done. The man is then turned over to an instructor who gives him an intensive course in pedagogics lasting from five to six weeks. At first sight it would not seem necessary to instruct a man, but it is not generally understood that teaching after all is itself a trade. The experience with the men in this respect is most interesting. In nearly every case the man has resented this course at the start, but at the end has turned completely around and in many cases has desired an even more extensive training. What is really accomplished is to give the man the necessary confidence to impart the knowledge that he has gained to another green man. The men under training are taken from the various industries, especially the shipbuilding industry, and after they have finished their instructor course are returned to their employer to carry on the instruction, in their own plant. The men who go through this training as provided by the Emergency Fleet Corporation are certificated when they have shown themselves to be entirely proficient. It is not possible nor expedient for the Emergency Fleet Corporation to require the certification of all electric welders. It is the consensus of opinion that all industries doing serious work with the electric arc should use men who are ceritfied as to their ability in the art of electric welding. The main reason for this opinion is that the operator must be a conscientious workman or the weld will not be of perfect quality.

This brings forward another problem upon which a great deal of experimental work has been and probably will continue to be done, namely, a practical and scientific method of testing a welded joint that has been made. There have been a number of suggestions made for the solution of this problem. They are briefly, as follows:

(a) Mechanical. By hammering the weld or by chipping at frequent intervals.

(b) Electric. By means of resistance or voltage drop.

(c) Magnetic. By means of the permeometer or the change of conditions of the magnetic circuit.

(d) X-ray. By means of an exposure on an X-ray plate.

At the present time none of these suggested methods have been productive of conclusive results and recourse must be had to the purely mechanical methods of striking heavy blows on, or adjacent to, the weld or by using a chipping hammer and making intermittent examinations. It would seem by far the best procedure to make the inspector proficient in the art so that he may closely observe the welders while at work. This may be accomplished by a two or three weeks' attendance of inspectors at any one of the electric welding training centers.

Methods of Electric Welding

There are many methods and processes of electric welding but the two main ones that interest the committee at the present time and alone have been mentioned so far are the spot welding and arc welding. It may be a surprise to some of the old time welders to consider electric welding as a new industry. In substantiation of this statement it may be well to describe briefly what is meant by electric welding as it is practised to-day.

Spot welding is not much different in the methods of procedure or in design of apparatus than when it was first introduced. Copper electrodes, water-cooled in the heaviest machines, are placed on opposite sides of the material to be welded together. The joint is a lap joint. Machines are now so designed that two spot welds may be made at one time. The routine of the operation is as follows:

The electrodes are brought into contact with the materials to be joined, current is supplied sufficient to give the required heat, pressure is then applied, the current is removed, and the pressure is removed, the weld is then complete.

The operator has a perfect indication of making a good spot weld by the use of a button placed under the electrode, observing which he knows exactly the proper timing of the operation. There is, therefore, no question as to a good, bad, or indifferent, spot weld. Automatic spot welders have been designed and built, but it is the general opinion that they add complication to a process which in itself is very simple.

The process of arc welding is as follows:

One side of the electric circuit is connected to the material to be welded; the shank material is usually prepared by bevelling the edge of the pieces to be welded together. The other side of the electric circuit is connected to the electrode. By touching the electrode to the shank material the arc is drawn. The skilled operator now moves the electrode from side to side of the groove giving a semi-circular motion while at the same time moving the electrode along the groove.

It is important that the arc "bite" into the shank metal creating a perfect fusion along the edges and the movement of the electrode is necessary for the removal of any mechanical impurities that may be deposited. In the coated electrode it is further necessary that the slag which forms for the protection of the pure metal be worked up to the surface and it is extremely important in the event of a second or third layer that the slag or impurities be carefully scraped away before the virgin metal is again laid on.

The operator in arc welding is protected with either a hand screen covering his face with special glass through which to observe his work. The electric arc emits dangerous invisible rays in both the upper and lower spectrum scale and it is quite evident that both the infrared and ultra-violent are dangerous in their effect, the former is pathological, the latter actinic. The operator further uses gloves for his hands and for the very difficult work of overhead welding it is necessary for him to use a helmet which partly covers his breast.

The tendency of developments in spot welding has already been slightly touched upon. In their nature as applicable to shipbuilding the advancement will naturally have to proceed toward means for accomplishing spot welding in very cramped locations. This makes an exceedingly difficult problem as the power requirements are such as to preclude any very small device. In riveting one-half of the apparatus is on one side of the work and the other half on the opposite side and it is difficult to conceive of any method of spot welding that will admit of such an arrangement. In shipbuilding it is quite probable that designs may be made that will permit of a large or at least increased amount of spot welding in the actual construction of the vessel. Certainly, present designs of riveted ships will not allow of this to any great extent. As already stated, spot welding can now take its place in the fabricating shops and it is to be expected that within a few months spot welding will begin to supplant riveting in this field. The only drawback to this will be the sufficient production of spot welding apparatus.

The tendency of development in arc welding is toward the automatic machine to obviate the responsibility that has to be placed upon the skilled operator. Intensive work has been done within the last few months in the line of automatic arc welding machines and at the present time sample tests of welds made by such apparatus have been sent to the Bureau of Standards. These machines will occupy a very important position in repetition work. They will not immediately supersede the skilled operator in repair work, or in special jobs but it may be expected that the development of such machines will bring apparatus which can be man-handled and will eventually take the place of most of the hand work as it is now known.

Of the scientific advancement in the art of electric welding there is so much to be treated that only a general outline can be considered at this time. The research work has only just begun. Practice has preceded the scientific investigation. The field, therefore, is full of most interesting problems. Those who have been following the development of the past six months are deeply interested to know the fundamental reasons. The investigational questions may be grouped into three main divisions:

1. Metallurgical; 2. Physical; 3. Electrical.

The metallurgist has yet to tell us what the conditions of the metals are after the electrode material has fused with the parent metal, and to determine what the proper conditions must be to produce a good weld. This problem has in it a great many variables. The physicist must explain the atomic or electronic conditions which permit of the combinations at the high temperatures involved and must explain the phenomenon of overhead welding. The electrical investigator must determine all the various phenomena connected with the preferences between and the advantages of the use of different forms of electrical energy and the varying characteristics of the electric circuit in producing different type of welds.

Conclusions

From the preceding remarks it must be conceded that the Welding Committee of the Emergency Fleet Corporation has already crystalized the problems connected with this art. The working functions of this committee have been laid down upon the broadest possible lines. Liberal opportunity has been given every one to state in detail his opinion and to express the reasons for his preference on every point connected with this subject. The committee goes even further than this. It furnishes those interested with every new idea that is brought to bear upon the subject after sifting from the suggestions any question of doubt or misstatement of fact.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

THREAD ROLLING IN A SCREW MACHINE

By M. H. POTTER

The rolling of threads by hardened rolls, or dies having threads which roll grooves into the blank and raise enough material above the surface of the blank to form a thread, has been in use some time, especially when a thread is required next to a shoulder where it would be impossible to cut with a die. The tool used when threads are rolled in an automatic screw machine is in the form of a disk, having a thread periphery and mounted so as to revolve freely when forced against the blank to be threaded, the thread on the roll or tool being the opposite hand to the one which is to be produced on the work. For rolling a right-hand thread, the work should revolve in the same direction as when a thread is cut in a lathe. The roll-holder should be provided with vertical adjustment, so that it can be set to the correct height.

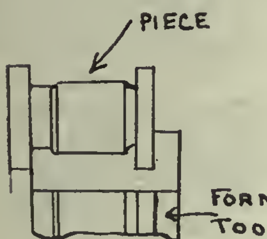


FIG. 1

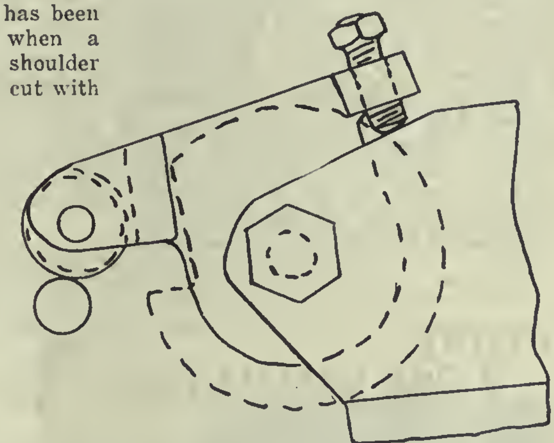


FIG. 2

Due to the difficulty in securing material for the rolls that will withstand the severe use of rolling threads in harder metals, thread rolling is only practical when applied to brass or other soft metals. It is possible, however, to apply this method of producing threads in steel when chrome-nickel steel rolls are used.

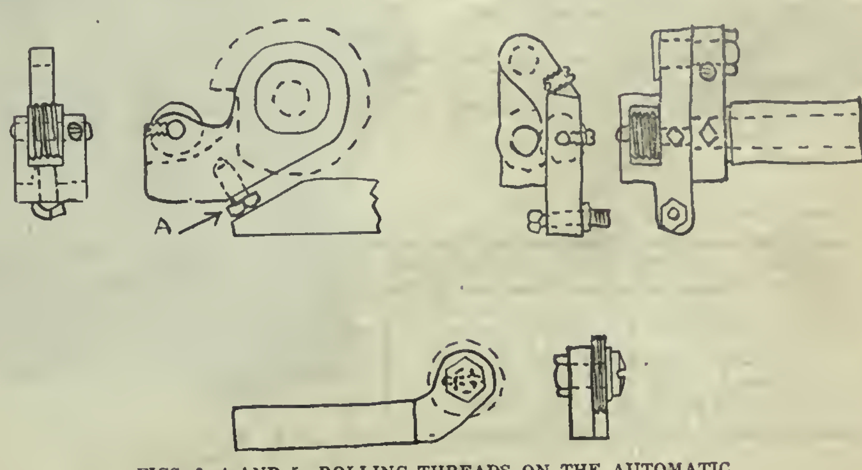
The diameter of the blank should be approximately equal to the pitch diameter. In the case of a U. S. standard thread, the diameter of the blank should be slightly less than the pitch diameter of the thread. The threads on the roll should be made sharp at the top, otherwise more pressure will be required to force the roll into the work, which will produce a rough, imperfect thread. In other words, all thread rolls, whether for forming a sharp V or a U. S. standard thread, are made with a sharp V at the bottom. As the outside diameter of the thread formed is governed by the diameter of the blank, there would be no advantage in having the bottom of the thread on the roll sharp, with the exception that it would be easier to machine the thread in the roll.

In making a thread roll, the outside diameter is turned to the size required, and the end beveled at 45 degrees to prevent the end thread from breaking out. The roll should be lapped after hardening in order to obtain a smooth finish on the threads. This is accomplished in the usual manner of lapping by means of a piece of hard wood charged with fine abrasive and oil, while the rol is rotated on an arbor.

As the part of the work on which the thread is to be rolled can be turned by a form tool, it is preferable to use a form tool of such a shape that it will cut a groove at the end of the thread to be rolled, i.e., the end next to the shoulder. This is illustrated in Fig. 1. It is also desirable to reduce the diameter where the work is to be cut off from the bar stock; this is also shown in Fig. 1.

Naturally, the method of holding and applying the roll is governed by the relation that the thread rolling operation bears to other machining operation on the piece. The design of holder for the thread roll is also governed by the type of screw machine for which the holder is intended.

The holder shown in Fig. 2 is attached to the cross-slide and operates tangentially on the top side of the work. The one referred to was used on a Brown & Sharpe machine. There are no chips to interfere with the operation and the roll can be held more rigidly than by passing it under the work. This is due to the fact that the tendency is to raise the cross-slide instead of to push it downward. As will be seen by referring to Fig. 2, the roll rotates on a pin and is inserted in a slot milled in the end of the holder. The roll should be a good running fit, both on the pin and in the slot, as any lost motion would result in a marred thread. The



FIGS. 3, 4 AND 5—ROLLING THREADS ON THE AUTOMATIC set screw shown at the rear of the holder is used for setting the roll to the proper depth. In this instance, the cutting-off tool was located back of the thread doll so that the work will be severed from the bar before the roll returns. The roll should be moved in to about .010 inch from the work on the quick rise of the cam, and then be fed in until the roll is directly over the top of the work. The feed should be about .002 to .004 inch per revolution of the work. The roll then moves past the work rapidly, bringing the cutting-off tool into position.

The thread roll holder shown in Fig. 3 is attached to the cross slide, and the roll is so located that it passes beneath the work when forming a thread. The set screw A bears against the cross-slide and is used for adjusting the roll to the proper depth as well as for supporting the holder. This type of holder may be used when no other tool is operating on the work at the same time and there are no chips to interfere with the thread rolling operation. The cutting-off tool located back of the roll severs the work after the thread is finished, so that the roll does not come into contact with the thread on its return movement.

When the thread roll cannot be carried on the cross-slide of the machine, a swing tool of the design shown in Fig. 4 may be used. If it were necessary to feed in the cut-off or form tool more than once on the same piece, a swing holder should be used. This holder operates upon the same principle as an ordinary swing tool for turning. The swing arm which carries the roll and which is moved inward, for bringing the roll into contact with the work, by means of a raising plate attached to the cross-slide which engages the set screw located at the end of the swinging arm. The shank of the holder is inserted in a hole in the turret. If the length of the work exceeds about 2½ times its diameter, the swing-roll holder should be equipped with a support. A hole drilled through the shank of the holder and a set screw is provided for holding the supporting member. The method of applying this support is governed by the shape of the work.

A type of thread-roll holder commonly used on multiple-spindle automatics is shown in Fig. 5. The thread roll is fed in radically to the work and slightly off center, so as to permit the tool to swing away a certain amount to follow the curvature of the stock. This makes it unnecessary to set the tool absolutely correct in regard to position for depth of thread. The spring of the tool should not be excessive, but just enough to relieve the strain which would be imposed on the tool if it were in a central position.

FORM FOR MAKING MACHINE COST ESTIMATES

WHILE it mav be that there is nothing particularly new about the estimate form shown in Fig. 1. its use does not appear to be general in some shops. The large concerns usually have estimate forms which save time and work, but the little fellows do not generallv seem to appreciate the value of "tools" of this character. In a small shop where there are not many estimates to be made the form shown can be drawn in ink on tracing cloth and a brown-print negative made from the tracing. Then, to obtain white, blank forms, upon which estimates can be compiled, blue-line white prints may be made from this negative. Where the number of estimates made is large, the form should, of course, in order to insure maximum economy, be printed.

As to size, it is convenient to have the form reproduced on 8½ by 11 inch sheets—the standard size letter sheet—so that the estimates may be filed with other correspondence and in the job envelopes without folding. For certain classes of work, however, an 8½ by 11 inch sheet may not be large enough, in which case the size of the sheet can be about 12 by 16 inches.

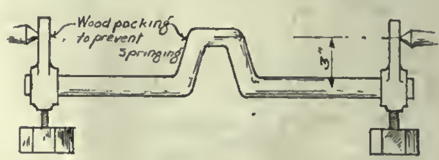
The feature of the form which renders its use desirable is that the principal component costs—some of which may, if they are not carefully listed, be overlooked—are all set down in black and white on the form so that the possibility of omitting some cost item in making the estimate is reduced to a minimum. It may be desirable for certain lines of work to include cost items, other than those shown in Fig. 1, on the form.

As will be noted, the first columns give an estimating description of each piece, the number of pieces required; the kind of metal in the column headed "of," the weight of the piece, the price per piece and the total cost of the number of pieces of each kind. The columns headed "price" and "cost" are not filled out until the pattern cost, machinist cost and the blacksmith cost detailed in the three main columns to the right have been compiled. This form has been used for a number of years, substantially as indicated in Fig. 1, and has been found wholly adequate. —G. L. Waters.

TURNING THROW OF SMALL CRANK SHAFTS IN CASES OF EMERGENCY.

By J. J. DIXON.

In the ordinary way of turning the throw of crank shafts it is necessary to have two quadrants to get the required distance of centres from body of shafts. To make these takes up considerable time and often costs more than the operation of turning the crank and are not required again for a considerable time. This expense and time can be saved by adopting the following wethods:—Take two ordinary lathe dogs, which will take in the size of the body of shaft, lay the shaft on marking-off table, put the dogs on each end, line them up with surface gauge, strike the centre line with body of shaft, then with compass strike the required distance of throw, drill centres in dogs where lines intersect. This must be done while dogs are in position, care being taken that dogs are well tightened down on shaft—a careful lathe hand will have no difficulty in turning a crank throw by this method, the writer having done this with cranks up to a 4-inch throw.



METHOD OF TURNING CRANK

Portable electric machinery has been invented to screen coal and load it in wagons.

Sheet No. MACHINE ESTIMATE For

Drawing No. Date

NAME	No.	Of	Weight	Price	Cost	PATTERN				MACHINIST									BLACKSMITH		
						Hours	At	Cost	Supplies	Plane	Turn	Drill	Mill	Fit	Total	Price	Cost	Supplies	Hours	At	Cost

FORM FOR COST ESTIMATES

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

DANIELS AUTOMATIC MACHINE

WITH the object of providing an easily operated automatic machine for making a variety of machine parts, only semi-skilled labor being employed, the machine shown in the accompanying illustration was recently developed. It is the invention of Lee G. Daniels and David Sundstrand, both of Rockford, Ill., and is being manufactured by the McDonough Mfg. Co., Eau Claire, Wis. In principle, the machine resembles the modern manufacturing automatic of the type having several working stations and one loading station. As the illustration shows, the machine is of the vertical type, the object of this design being to facilitate loading and unloading.

The machine handles work from 2 to 6 inches in diameter and performs the following operations: Cup turning, drilling, boring, reaming, facing, tapping with collapsible taps and drilling multiple offset holes by means of an attached multiple-spindle auxiliary head to any of the spindles.

The machine has five tool carrying spindles and a blank station. The turret, upon which the spindles are mounted, does not revolve but through its automatically controlled vertical movement, feeds the tools to the work. Its axis is concentric with that of the table.

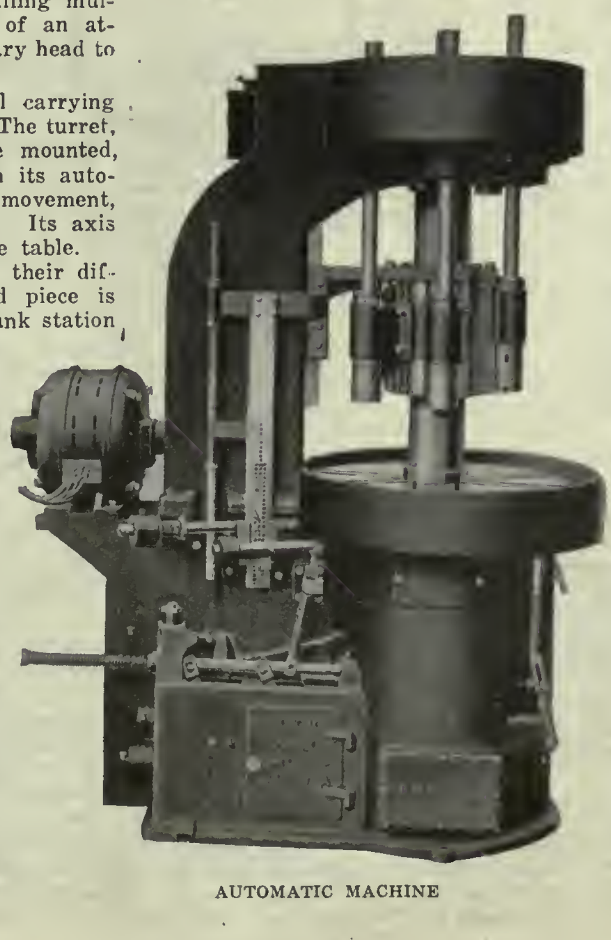
After the spindles perform their different operations, a finished piece is removed when it is at the blank station and another substitued. The time of machining a given piece is the time of the longest operation plus the time of one index.

The table has six chucking positions and revolves step by step, bringing each chucking position successively in alignment with each spindle.

On one machine now in operation, machined pieces are turned out, it is said, at the rate of one every two minutes. Three machines which were previously required for machining the parts, have been eliminated and three operators released for other work.

The spindles have a rapid approach toward, and a rapid reverse from the work. The spindle carrier is operated by means of a quadruple screw operating through a bronze nut in the center column. The screw is revolved by means of a worm gear and the worm by means of three friction clutches, one for a rapid approach, one for the feed and one for a rapid reverse. In obtaining these movements through friction clutches, the machine is protected because if a tool should break and jam in the work, the feed pressure would go up and cause the feed friction to slip, thus automatically protecting the machine. If in the movements of the rapid approach or reverse or indexing of the table, any of these should jam into anything, their friction clutches would slip.

The table is 36 inches in diameter, and can accommodate six 10 inch chucks or work holders. The travel of the spindle carrier is 13 inches, and it takes 4 inches of this movement to withdraw the locating pin and to control the indexing of the table. The table can be set to index one, two or three spaces, depending upon the operations required.



AUTOMATIC MACHINE

The speeds are varied by means of change gears. There is one set that controls the speed of all the spindles and each spindle also has an individual set of change gears, so that each can be given the most efficient speed for any particular operation.

NEW DESIGN OF BORING MACHINE

By J. H. RODGERS.

Difficulties contingent to the boring of the heavier shells has been one of the greatest problems of munitions manufacture. Owing to the length of the bore the cutting tool required to be at a correspondingly greater distance from its fixed support in the turret or carriage. This not only meant that the cutter bar must be made as heavy as conditions would permit, but the slides and other movable parts of the carriage should be as close a fit as possible consistent with effective operation. Various tools have been designed for this work and many have attained a high degree of efficiency, virtually revolutionizing the operation of shell boring. Overcoming the leverage created by the excessive overhang of the tool has been the general object of the various designs, but few have entirely eliminated this weakness. Heavy and large diameter turrets, increased bearings given to carriage ways, tail pieces extending back to the lathe shears, and other methods, have been adopted, but although they assisted to maintain the accuracy of the work the fault still remained in a modified form.

The machine here illustrated has been designed and constructed by L. A. Desy, consulting engineer of Montreal, and incorporates some interesting features of construction. In proportion to its capacity, the machine is relatively light in weight, but the construction is such as to maintain the initial accuracy and rigidity under long and continued service. The general appearance of the machine differs little from that of other boring tools, with the exception of the arm and the support for the cutting tool bar and forming point; but these portions of the machine vary considerably from the usual design, inasmuch as the troublesome leverage has been amply taken care of, the tool being provided with both horizontal and vertical support, forming what might be termed a three-point radial bearing. Of course, the spring of the boring bar still remains, but with the bar made of ample size the trouble from this source is very slight.

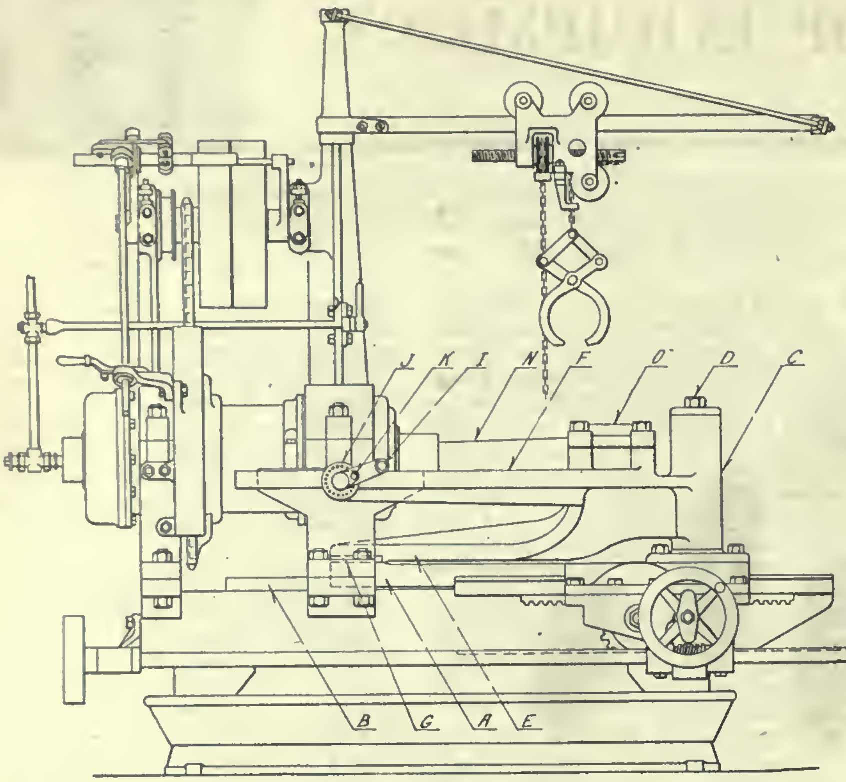


FIG. 1

As shown in the assembly view, the carriage is provided with a heavy arm A that extends forward and beneath the front head stock bearing, this being of the bridged type. A groove of ample width and depth is made in the lower outer end of this arm that fits closely on the tongue slide B. The carriage is provided with a pivot D upon which the main casting C is fulcrumed. The lower section of this casting forms an arm E that extends forward and under the headstock, the extreme end being machined to slide freely on the upper surface of the carriage arm A. The saddle arm has no side movement, but the upper one is made flat to allow of side motion for setting the tool and shaping the desired profile. The horizontal arm F extending out to the front of the machine, carries at its extreme end the forming point H, which is in a direct line with the cutting tool.

A feature of the adjustment is the method of determining the setting of the tool for the removal of metal. The adjusting screw is provided with an integral collar J containing a series of 25 equidistant spaced holes. The small crank arm is fitted with a spring pin K that enters one of these holes and locks the two parts together. The outer end of the small crank arm carries the handle and stop pin I. The pitch of the adjusting screw is 1-16 inch and the disc contains 25 holes, so that the adjustment between two adjacent holes would be 1-400 inch, or a difference on the diameter of about 5-1000 inch. The sizing and profiling cam L is secured to a support M on the front head stock and is capable of close and accurate alignment.

The spindle chuck is so constructed that a positive grip is provided at each end of the shell. The air operated cylinder B is fitted to the rear of the spindle in the usual manner and is provided with a small feed pulley C, the air connection D being of special design with the air inlet in the middle. The push casting F is secured to the piston by means of bolt G, this bolt serving in a double capacity, the front end supporting the ejector H operated by the spring I. The rear collet J is operated direct by this push casting, and by means of the body bushing K, the front collet L is operated, the screws M preventing the jaws from side movement. Six springs N, bearing against the piston and the ring O, return the piston to its released position,

This action is assisted by a series of small springs P, placed between the push casting F and the body bush K. These machines are being manufactured by The J. W. Harris Manufacturing Co., of Montreal.

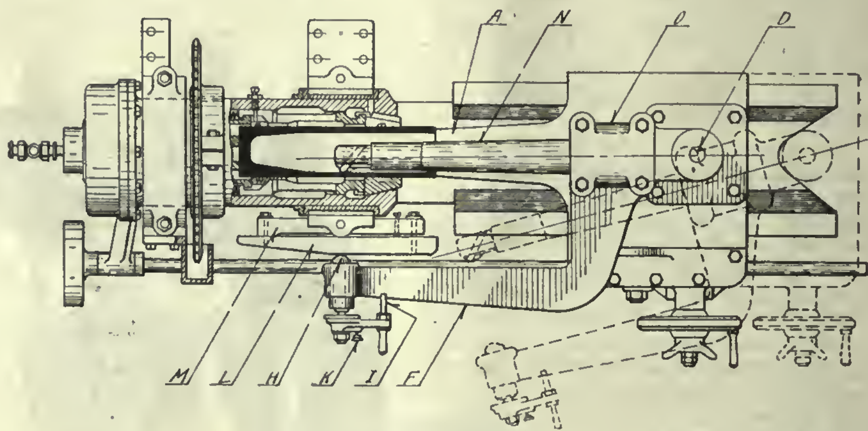


FIG. 2

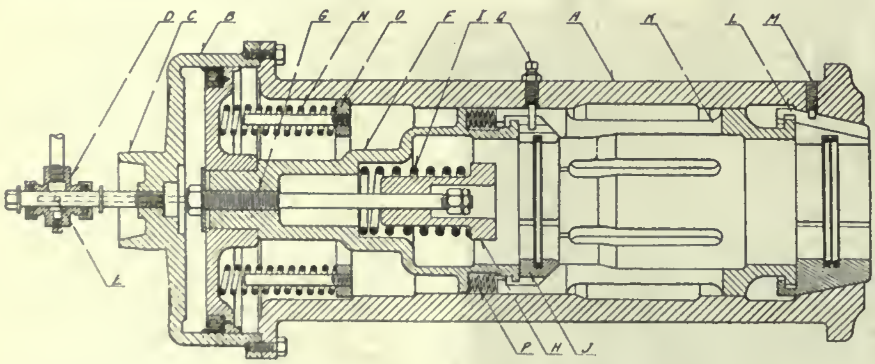


FIG. 3

Owen Sound.—The Corbet Foundry & Machine Co., Limited, Owen Sound, are building six automatic towing machines, of their No. 5, or longest type, to be installed in six ocean-going tugs now being built at Buffalo. Mine sweeping attachments, consisting of gears, shafting, and drums are included in the specifications. Each towing machine will be equipped with 1,800 feet of 2-inch hawser. The tugs are being built for the U.S. naval service and are to be employed in mine sweeping and other lines of ocean duty. The Corbet plant is employed on much other work for ships now building in yards from Halifax to Vancouver.

Technical Journal Best Aid to Education

Stationary Engineering Becoming Highly Technical and Specialized Avocation With Increasing Prestige—The Technical Press is Recognized as the Best Means For Procuring Advancement Through Increased Knowledge

By S. BALMFIRTH, Engineer Sick Children's Hospital

IN these days of war, of coal shortage, and rumors of further shortage, the engineer is being called upon for increased efficiency as never before.

Coal, which two years ago was plentiful and fairly cheap, is now scarce, poor in quality (frequently) and high in price.

These conditions have resulted in a demand from manufacturers and governments for a more efficient and economical system of power generation. That is to say both manufacturers and governments are putting the question right up to the engineer as being the man most likely to produce the results required.

However the work of a steam engineer is not learned in a day, but is a long, tedious and very often painful process. The engineer, unlike most of the manual tradesmen, is never out of his apprenticeship. He is like a man rowing a boat upstream; if he stops rowing he drifts back. So it becomes every engineer worthy of the name to keep everlastingly at it. In fact in these days of progress and invention in every line of business, it is absolutely necessary that one devote a fair amount of time to learning the finer points of one's chosen line. Nowadays the up-to-date chief engineer is being classed, at least as a semi-professional man, which is only right for certainly steam engineering has got past the old rule-of-thumb days.

Time was when the fireman of to-day was the engineer of to-morrow. That is, the beginner in the steam engineering profession began as a fireman, and from the experience he got as such, and from his observation of what the engineer did and from what the engineer was willing to show him, he progressed slowly and laboriously until he had sufficient knowledge (or thought he had) to apply for a position as engineer. If he succeeded in getting a position as engineer, his troubles began. Then he found quite frequently that engineering was "not just what it's cracked up to be!" However, if he succeeded in keeping the wheels turning without having to call in outside help, in most cases he would be able to hold down the job long enough for him to learn more about his business.

Of recent years, however, in keeping with the general progress of education the engineer is fast coming into his own.

No longer is he known as "the man in greasy overalls carrying a monkey wrench," although both these articles are very necessary adjuncts, but he is being recognized as a very necessary and important man in any business, by the most prominent manufacturers.

It is not necessary for any engineer to depend entirely upon his own experience for his information. Nowadays there are books published for self education (some of which are suitable and some are not), correspondence schools, free libraries, night schools, engineers' associations and many other ways open to the seeker after knowledge.

The writer has used most of them, with varying success. Experience is, no doubt, the best teacher, but her course is very expensive. So it is very much less costly to use the other fellow's experience.

Any one can profit by his own mistakes, but it takes a wise man to profit by the mistakes of others. Of the sources of information mentioned above each has its good points, and each its disadvantages.

One of the disadvantages of the technical book, is generally speaking, it is not written for self education. It may be intended for that purpose, but very frequently falls far short of fulfilling its purpose. Many of them are couched in language entirely beyond the average engineer's education, and require a teacher to explain. Further, the best book written at once grows old and out of date the moment it is published.

Correspondence schools fill a great want in this regard, in that their text books are generally written for self instruction. Most of them are written in simple language, and carry the student along step by step from the first rudiments of the subject in hand to its final conclusion. Further the correspondence school saves the time required in travelling to and from home and school, and also makes use of any odd minutes that the student may have to spare. The writer put in a good many hours' study on the street cars.

Technical schools, that is evening classes, are an excellent means of providing higher technical education for the man who can attend. But right there is also the disadvantage. No course of lectures will benefit a man unless he can attend all, or at least the largest proportion of them, and the average plant engineer cannot be certain of being able to attend all lectures. Things have a habit of going wrong on class night, and one of the most important lectures is missed, and then the whole course is thrown up in disgust. Then again many engineers cannot attend by reason of the time of their watch, so that they have to forego the benefits of the night class.

Still for those who can attend the night technical school is an ideal means of acquiring an education; combining as it does the use of spare time with both practical and theoretical courses of study.

The engineers' association is a very good means of self improvement; in fact one of the best. If the association is at all alive, discussion of various subjects of interest to all engineers is the main part of the evening's business. Every one has a chance to express his opinion, and many and various are the opinions expressed at times. Still, by discussion one learns, and by friction a polish is given. So that even if one makes mistakes in giving expression to one's opinion, it is not often that one makes the same mistake twice. Then again a mistake made in discussion of any subject is much more easily rectified than a mistake made on the job; it is not likely to be so costly either. The older engineers are always ready to help the younger ones, by giving them the benefit of their experience.

But!——— if you wish to learn about any subject, write about it. One could safely say that what one writes about, one remembers best. Not only that, but what one writes about one generally takes care to be accurate.

So, the technical magazine has a field all its own. In it one can express one's opinion on any subject covered by the magazine. Not only that, but the criticism evoked is often constructive, in fact generally so. Further one can ask any question and be sure of geting an answer. There is generally someone who knows the answer to the question and is willing to pass the information along.

The technical magazine has one great point in its favor, that is, it is never out of date. One can always be sure of finding the latest improvements and the newest inventions in its pages. Then again the advertisements are a fruitful source of information of what is new and

Continued on page 657

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A Big, Serious Question Ahead

THE parliamentary secretary of the Department of Civil Re-establishment has resigned. This is not the time for men in that kind of work to be quitting the job.

If conditions were such that he could not work to advantage, then put conditions right.

The war wound up with such a rush that the government was not prepared for it. That, at least, is the most plausible excuse that can be put up. But just now people are not strong on accepting excuses.

The responsibility of the government toward the industrial life of the country does not end with the signing of an armistice. The government, through conscription and its War Trade Board, and the operation of the Imperial Munitions Board, created the war machine. Having created it by turning the industrial life of the country up on edge, the duty now is to restore it to something like normal conditions.

It must be remembered that manufacturers in Canada were denied access to the steel markets, to the pig iron markets. Canadian industry has been at the beck and call—and willingly so—of the Canadian war machine.

And now what? The government cannot say, "The war is won, and we're through." No department dare drift until the resignations of able members are necessary.

"One Thousand Hands Laid Off At Shell Plant." That's bad business, and it's dangerous business as well.

These one thousand have made good money. They have needed good money to pay 15 cents a quart for milk and seven cents each for eggs.

Turning thousands of men into an unprepared labor market, with the price of food still at the peak, is simply harrowing and plowing and sowing the seed that springs up into Bolshevik ideals and mob excesses.

If ever there was a time in the history of Canada when the country had a right to look to Ottawa for sane deliberation and fearless action, that hour has struck.

The body that had to do with war contractors, viz., the Imperial Munitions Board, will cease to exist in a few days. To whom, then, are the manufacturers to turn if they want a hand at getting back to old lines that have been sacrificed or neglected in the rush for maximum munition production?

Canada does not stand in the place of a nation that has to deal in a niggardly way with the situation. It is better to blunder by too great efforts and consequent expenditures than to court trouble by meeting the situation with the vision of a pinhead and the courage of a slacker.

The suspicion grows that Ottawa is not in shape to cope with the situation. It may have been commendable in the days of Micawber to "wait for something to turn up," but that sort of stuff won't do to-day.

There must be the same energy in looking after the returned man that was displayed in signing him on, cheering his departure and noting the progress he was making in France.

Ottawa has a chance right now to make a big success, or a failure that can be nothing short of an awful mess.

Dealing With the Foreigner

THE Department of the Interior of United States is now issuing a little paper called "Americanization Bulletin," with the idea of working with the foreigners of that country toward the end of better citizenship.

There is a great big field here for the United States or Canada for that matter. The trouble in the past has been that the foreigner has come to this continent as a foreigner and he has lived as one. He has not become a citizen of United States or a citizen of Canada.

To be true we do pay some attention to the foreigners in this country. We send inspectors now and then to raid their houses to see if they have more than the regular schedule of liquor. We send other officials to look around their back yards and see that they are up to snuff from a sanitary standpoint. And to be true we have them rounded up in court once in a while, and through an interpreter we tell them that they must part with five and costs for living in this country the same as they have been used to living in the land of their birth and former residence.

But apart from that what do we do for the foreigner that will make him a better man for this country? The answer to all this is "Mighty little."

People in this section of the country may not see the problem in the same light as those who live in corners of the country where the foreigners have a chance to hive. In these places they dominate the situation in many ways.

If all we can do with the foreigner that comes to this country is to get him to do work that the natives won't do, then we can't expect to amount to much as a nation. It is an admission that we have no national ideals, or no scope past the pitching of the foreigner into the industrial sausage mill and making him spit out dollars.

The foreigner as he comes to us is a problem. In fact he's so big a problem that we can't afford to ignore him. From the low plane of self-preservation we will have to take notice of his presence.

The Department of the Interior of United States is working toward the right end. It's to be hoped that their efforts are not allowed to come down to the poor status of academic discussion. The Department is up against a big problem. If it solves it the country at large gains. If it does not the country is the loser to the same extent.

At a banquet in Toronto the other night the chairman announced that they would sing "God Save the King." Whereupon one husky spoke up and said, "Sing hearty, boys, there's not many of them left."

STUDY AND TRADE PAPERS LEAD TO SUCCESS

Walter A. Janssen, Operating Manager Canadian Steel Foundries, Ltd., Montreal

WALTER A. JANSSEN, operating manager, Canadian Steel Foundries, Limited, Montreal, was born in Davenport, Iowa, and received his early education at Freeport, Ill. In 1907 he graduated from the University of Wisconsin in chemical engineering. His work as draftsman and later chemist prepared him for his position of superintendent of the open hearth department and then the Steel Foundry of the Bettendorf Company, from which position he accepted that of operating manager with his present firm. Mr. Janssen is single and resides at Freeman's Hotel, Montreal.

W. A. JANSSEN

"The value of study by young mechanics," stated Mr. Janssen, "can scarcely be over-estimated, and their training is a most important factor in the success of the country's industries. Trade papers are the great clearing house and connecting link which bridges the gap existing in manufacturing circles between the office and the working force, and their educational value is conducive to greater co-operation and advancement."

At the last annual meeting of the American Foundrymen's Association, held in Milwaukee, Mr. Janssen was elected vice-president.

A 77½ Per Cent. Increase

IT'S not telling a man anything new to state that living is higher than it used to be. He knows that, and he has had it rubbed in so hard that it's almost coming through on the other side.

The U.S. Bureau of Labor Statistics has issued a book which goes into the subject pretty thoroughly. Conditions, as borne out by official figures in Canada, are much the same.

Of course there's not a heap of satisfaction in reading that your 1914 dollar has been steam rollered until it's only worth about 50 or 60 cents. But all the same it helps to answer that grand old query: "Where in Sam Hill does the money go?"

Here are a few comparisons between the first year of the war and now. The figures given represent the increased percentage of cost to the buyer:—

Sirloin steak	68
Round steak	82
Rib roast	69
Pork chops	77
Bacon	91
Ham	73
Lard	106
Hens	77
Butter	33
Milk	46
Flour	103
Corn meal	123
Potatoes	71
Sugar	65

That is an aggregate increase of 1,085 per cent. for 14 articles, or an average of 77½ per cent.

And the man who has been on a fixed salary during the war, or who has had even fairly liberal increases. finds himself still banging away with a comparative popgun at the High Cost of Living, when he needs a 14-inch shell to make a dent in the thing.

The Future of Aeronautics

HANDLEY PAGE, the maker of the famous bombing plane, has a great vision of the future of the plane in commercial business. In the *Empire Review*, he has this to say:—

"These service machines will, with some necessary internal rearrangements, make useful commercial vehicles for the conveyance of goods and passengers, the latter traveling, six or seven together, in a roomy, totally enclosed cabin. Such machines will be able to distribute the world's mails in hours where it now takes days. They will travel from country to country, and continent to continent, seeking their objectives in direct lines, ignoring the enfeebled barriers of hills and water, eliminating distances, and bringing to our shores the very outposts of our Empire. In machines of this size no part of the Old World is inaccessible, and before long the anticipated conquest of the Atlantic will bring the territories of the Americas within their reach. Trade will be facilitated and accelerated. Journeys to Africa, the East, and Australia, which are now matter for long consideration, will be undertaken by the busy man and performed at the expense of a day's time. Principal and agent will meet where they now correspond, and augmented knowledge of market requirements will result in the production of goods more readily acceptable. Planters will bring or place their samples in London and Liverpool within two or three days of plucking in India, and manufacturers will be able to grant the short time necessary to inspect their raw materials at the source."

This would mean, approximately, that a person could leave New York on Monday morning and be in London, Eng., on Wednesday morning. At the proposed six cents a mile, the cost of the trip would be over $200, quite an increase over present prices, but not a serious item to the man who wanted to cross quickly.

TECHNICAL JOURNAL BEST AID TO EDUCATION

Continued from page 655

what is standard and reliable, so that, generally speaking, the technical magazine may be made one of the best means of keeping up to date.

But to the engineer it may also be a source of revenue, besides being a general depot of information. If you have any experience that strikes you as being out of the ordinary, write to your magazine about it. If it's good enough to print, its good enough to pay for. It does not really matter if you never wrote for publication before, if the language you use is ungrammatical, or if your spelling is of an order not mentioned in "Webster's Unabridged"; send it in The magazine has men whose special job it is to clothe your idea in suitable and proper language and fit it for presentation. If you can make a sketch to help illustrate your idea, all the better. It need not be a scale drawing or an artistic piece of work; if it expresses your idea, the artists on the staff of the magazine will make a good drawing of it.

Possibly a single instance may illustrate the idea. The writer had occasion to give a paper at one association meeting, which dealt with the writer's everyday work. The writer's opinion, when he began to prepare the paper, was that he knew sufficient about the subject to make preparation unnecessary. However, as the paper progressed the writer found that his knowledge of the subject was not quite so full as he thought, so he had to consult various works of reference, but by the time the paper was ready to present the writer knew what he talked about, and in the discussion which followed the paper the writer was able to answer every question and argument. Before the preparation of the paper the writer thought he knew, afterwards he did know. Writing about a subject impresses almost indelibly on the memory.

MARKET DEVELOPMENTS

Not Anxious to Get Under the Price Drop

Inflated Values Must Come Down in Certain Lines, But No Section of the Trade Shows a Willingness to Bear the Burden—Scrap Market is Still Out of Business

MUNITIONS business in the Dominion is nearing the end. Nearly everything has been cancelled with the exception of one or two American contracts, and there seems a bit of a chance that these may stand. One is the 240-m.m. contract, a new shell with a tapered body, guns for which are now being built at American plants. This contract has not been cancelled. The making of fuses and adapters is still proceeding. In many cases shells are simply being stored near the point of production, and their ultimate disposal seems open to question.

There seems to be a disposition on the part of the trade in machine tools to dodge the day when price adjustment must come. Machine tools at the moment are about 75 per cent. in advance of normal times. It is hard to imagine that pre-war prices will prevail for some time at least, but even so, there is too much margin at present between present and old prices to encourage buying. "Let George do it" seems to size up the situation very concisely. There is also a disposition on the part of manufacturers with standard lines to hold back yet, waiting for raw material and labor to come to a lower level, knowing that the chances are that goods made now will have to be sold into a lower market by the time they have gone through the various channels of distribution.

For all practical purposes the scrap metal market does not exist at the present time. Toronto dealers admit that prices quoted are simply nominal, and only represent the comparative value when placed against the metal in ingots. They will not pay the prices quoted. That seems quite certain, neither will they name other prices because there are no deals going through on which to base the new figures. Montreal goes one better and places the figures much lower this week. The situation is not likely to improve for some time to come.

Prices of steel plate and sheets came down again during the week. There are large shipments of boiler tubes coming now, and the new lists will show a downward revision of from five to ten per cent.

There is nothing to indicate that there is going to be any sharp decline in the price of steel. In fact everything is against it. The American situation at present, on account of fully 80 per cent. of our steel being imported, finds a quick response in the Canadian situation. At U.S. points was prices for labor are still in vogue, and indications do not point to any considerable dropping in prices of finished goods.

MONTREAL HAS CUT INTO PRICES ON THE SCRAP METAL TRADE

Special to CANADIAN MACHINERY

MONTREAL, December 5.—Canada is about to start up a new epoch in her history, particularly in connection with her industrial activities. There is little doubt that munitions making will soon be a thing of the past, as recent instructions make it certain that shell production will completely cease by Christmas. It was announced some time ago that work on the British contracts would terminate on the 14th of the month, and last week word was received from Washington that the time limit on American operations would run until December 24, the date set for the final work in connection with this branch of war work. Factories in this district are now cleaning up on the machining of the shells, all primary operations having been stopped from two to three weeks ago.

Interest is centered at present in the early attitude of the government in connection with reconstruction problems. Many are anticipating a gradual return to normal activity through the present policy of the authorities at Ottawa, which, through the co-operation of the members of the War Trade Board, are hoping to secure considerable business for the rehabilitation of European countries. The removal of trade restrictions has cleared the way for a return to normal activities, but the prevailing high cost of material continues to be a factor for cautious action on the part of dealers and consumers.

Steel Still Shows Uncertainty

The steel situation in some respects might be said to have been relieved, but the general tone is still one of marked stability. Steel plates are about as hard to obtain as in the past, but the promises for the next quarter are more encouraging. It is not unlikely that the requirements will be lighter owing to the fact that the existing programme may be reduced. On the other hand many of the plants that have been working on shells are anticipating the going into marine activities, which will help to balance the stopping of munitions work. Apparently the railroads are awaiting a return to more normal conditions before starting on a buying campaign. In this respect it has been stated that the railways have been practically starved for the past three years, and replacements will be carried out as soon as conditions warrant it. It is not anticipated that any sudden decline will follow the cessation of war activities, as considerable business that has been put aside through the urgency of war requirements, is now coming forward, but the volume is restricted owing to the relatively high prices now prevailing. Despite this, however, it is not impossible that additional business will be placed even at prevailing prices. Local dealers report an unsettled situation, but a fair demand for domestic material. Some prices have declined, while advances are noted in others. The base price on iron bars, Montreal, has been reduced to $4.55 per hundred. Steel bars here are now $5.05 per hundred, a decline on the previous quotation of $4 per ton. Reinforcing bars are quoted at $4.50, a drop of $15 per ton. The reverse is shown in spring steel and band steel, the quotations being 8 cents and 5 cents respectively, the advance in the former case being 1 cent per pound, and in the latter ¼ cent per pound. This discount on cold rolled steel shafting has been changed, the present figure being 60 per cent. Black sheets, No. 10 gauge, has been reduced from $10 to $9 per hundred.

Complex Metal Situation

In common with other industrial situations, that of metals is reflecting the gradual cessation of war activities. The demand for munitions and ordnance purposes has fallen off to almost zero, but inquiries for domestic supplies have shown a slight increase, but the prevailing prices are not such as to induce consumers to buy more than they actually need for immediate requirements. Considerable interest is shown in the possible attitude to be taken by the American government in regard to copper at the beginning of the year. This is a factor that prevents active buying at the present time. Once the situation is cleared, whether at prevailing prices or an adjusted one, the way will be open for a renewal of ordinary demand, which has been materially interfered with owing to the restrictions imposed on the sale and distribution of the metal. The weaker scrap market in copper has affected the price of castings, the present quotation of 29½ cents being a drop of 1 cent per pound. The tin situation has become a little complex here over the prospect of an easier market. If reports are true, the Canadian supply on hand is more than sufficient for immediate needs, and, as a consequence, some dealers that have fairly large stocks, are a little anxious, not wishing to dispose of the metal at lower prices than what they had paid for it. The fact that the price control has been removed in England, has placed the market at the discretion of the producers, with the result that tin has dropped about $100 per ton. The export regulations, however, are still in force, and efforts are being made here by some of the metal interests to withhold the issuing of permits too freely until the situation on this side has become better adjusted. This week's quotations on tin are 2 cents lower than last week, the average price being about 83 cents per pound. The other metals are relatively quiet with the business gradually changing over from war to ordinary activities. On the whole, however, the entire situation is more or less unsettled, and will likely remain so until the turn of the year.

Little Doing in Machine Tools

Trading in machine tools has been very quiet during the past week. This has resulted from the decided action of the American government in closing up all business relative to shell production in this country. It had been thought that the initial contracts placed here would have been completed, but with the instructions to stop production by the 24th, all possibility of further activity is therefore removed. Machines that have been on order but not shipped have invariably been cancelled, particularly where these have been of a special character and adapted to shell work exclusively. Dealers are still taking on standard equipment, but general inquiry for tools is exceptionally quiet, although business is far from stagnant. Offers have been made to some plants for their equipment, but on what might be considered a scrap basis. The majority of plants are showing little anxiety regrading their equipment and are apparently in no haste to dispose of it. The supply situation is very quiet and the demand is nil for shell requirement. A much freer market is expected in regard to small tools and accessories.

Scrap Duller Than Ever

The announcement during the past week that all business in connection with American shell contracts would virtually cease before Christmas has added to the stagnant position of various lines of scrap. The present market is even more dull than that of the previous week, and dealers report nothing doing. There is now offering for sale many of the special machines that have been used for shell production, but dealers are a little reluctant in buying in this equipment. Scrap prices are all that can be obtained in event of disposal. On the other hand some manufacturers are showing no anxiety and will not talk business even from a second-hand standpoint. During the past week one local dealer purchased for scrap, the entire shell equipment of one of the smaller munitions plants here. The general quotations this week reflect the changes affecting old materials. Price changes in non-ferrous metals range from 2 to 5 cents per pound lower, and a decline of from $3 to $8 is noted on steel and iron scraps. Wrought iron car axles, listed for some time back at $40, is now quoted at $32 per ton. Boiler plates show a decline of $6 per ton, the price asked being $21 per ton. Stove plate has fallen off, the current price being $22 per ton, a decline on the week of $6 per ton. All copper scrap is down 5 cents per pound, with the market quite dull. Nearly all lines of scrap have been affected this week; changes will be noted in the selected market quotations.

POINTS IN WEEK'S MARKETING NOTES

Scrap prices quoted in this paper are merely nominal values. There are no deals going through and therefore nothing definite to judge by in the way of setting the price.

—

Nearly all the business that warehouses have been carrying in hopes of getting the steel mills to accept it is good. These orders are again being pressed on the mills for delivery.

—

A large user of steel expressed the opinion this week in writing that he preferred to buy material made in this country "even at a slightly higher price."

—

Prices of sheets are lower this week and it is intimated that shipments of boiler tubes now in transit will be put out at a reduction from present figures of five to ten per cent.

—

Munitions contracts in Canada will be out by the end of the month. Only a couple of American contracts stand much chance of surviving.

—

Pittsburgh despatches, in analyzing the present situation, are certain in their statements that there cannot be any decline to pre-war prices of steel.

—

Makers of pig iron are looking with confidence to the future. They state that there will be a greater demand for the output of the blast furnaces than there will be for steel.

—

Opinion at big American points seems to be that there will be no drastic cutting of wages. In fact the only chance for such a thing is in a swamped labor market. There is a tendency there, as here, for many foreigners to leave as soon as transportation is available, and this is counted on to take out much of the surplus labor.

PRICE ELEMENT IS NOT QUITE CERTAIN

Business Seems to Hang On That Point —Scrap Market Still Very Quiet.

TORONTO—If one were allowed to reach over and make use of a slang phrase to describe the market situation this week, it would be stated that the principal occupation seems to be the old game of "passing the buck." That is, every person admits that prices must sooner or later work to a lower level, and the whole circle of trade, from producer to consumer, seems to be engaged just now in keeping their toes well off the boards when the tumble comes.

Munitions firms are rapidly drawing their business to a close. The end of the present month will see the end of the industry in this country with the possible exception of a couple of American contracts. There also seems to be a chance that there may still be a call for fuses and adapters.

The prices that are quoted on all lines of scrap at present are simply nominal. That is, they represent the comparative values of the various lines when put up against the price for ingots. Because certain prices are quoted in another part of this paper is no guarantee that sellers can go to the yards and secure these figures for their scrap. In fact the chances are decidedly that they can not. For instance, quotations now give light copper at $20 per hundred, crucible copper at $24.50, heavy at $24.50 and copper wire at $24. This paper would change these figures if it were possible to replace them with anything that came any nearer to being the actual basis of dealing, but it is impossible to do this. Some of the dealers intimate that were copper scrap offered around 18 or 19 cents they might come into the market to buy, but at present prices they will not. The steel mills are not buying scrap either, and this tends to stop the steady flow of material through the yards. Dealers claim that mills are waiting for prices to actually some to a lower level. Many of the yards here are too well stocked with material that was taken in at fairly high prices. A dealer who has an immediate destination for material will come in the market to buy. Otherwise he will stay out, and the most of them for the present are staying out.

In Machine Tools

The sales of machine tools are not frequent at present. The situation is apparently waiting for prices to come to some sane basis. There has been a tendency in some quarters to chase up prices during the war rush. Of course, it is not going to hurt to drop this ultra-inflation, but when it comes to a point past that, there will be some difficulty. Prospective purchasers will probably be waiting for the market to return to something approaching the old-time prices of pre-war days. It is not likely that these figures will be realized, but there will be a movement in that direction and a very decided one. Machine tools right now are averaging about 75 per cent. higher than they were before the outbreak of the war. To the credit of some of the manufacturers of high grade equipment it can be said that they have not indulged in undue war profits. In other instances, though, the prices are yet too high.

There are indications of a break in the prices of some lines. It would not be safe to accept it as a sign-post of more to follow immediately, but the fact is significant and worth recording. A maker of radial drills is out with a list price of $4,700 on a machine that has been selling right along at $5,200. There has been no drop in the cost of manufacture. As a matter of fact the machines are the same as have been selling at the increased prices, and they cost the same amount of money to produce.

There is still a fair amount of business being done in the matter of supplies, and prices are not much changed.

Steel Prices Easier

It is interesting to note that nearly all the business that has been in the books of the warehouse people, is still good. There was some doubt in this regard, for in many cases it simply meant a policy of waiting until the state of the war was such that the non-essential lines could get a chance to come on the market. There has been apparently some misunderstanding that the priorities and preferences were all swept away as soon as the armistice was signed. This is apparently not correct, as the advice at the first of the week was that the export licenses were still necessary. This state of affairs will not stand very long, though, and it is only a question of days until the only open market is restored. As a matter of fact there is more old business being re-presented to the mills than new orders coming in. Firms making safes, for instance, have not been able to get into the plate market for some time, unless the orders were for a vault being put into some building that had some bearing on the war. Now, however, the prospects are that they can attend to the orders for this class of work. Makers of tanks, etc., are in much the same position. In fact some of the mills of United States that were working on war material exclusively have already intimated to their connections in this country that are "ready for commercial lines again."

A preference for Canadian material is being exhibited to a more marked degree by some of the purchasers. A warehouse sent out a list of material that was available—angles and shapes—to the trade here, and one letter from a

MONTREAL SHELL SHOPS NOT READY FOR ANY NEW LINES YET

MONTREAL, Dec. 4.—According to instructions recently issued by the Imperial Munitions Board, in compliance with a special circular from Washington, the plants here working on American shell contracts, will have until Dec. 24 to clean up on the work now in hand.

The Dominion Bridge Co. are now closing out on the final work on the old British shell contracts, and following the advice just received from Ottawa, will have about a month to continue on the U.S. orders. During the past few weeks about 1,000 men were released from the munitions end of the company's activities, and before Xmas it is anticipated that the total number affected will be about 1,600. It is more than likely that some of these will be retained in the general operations of the company, as the Dominion Bridge Co. is extensively engaged in the manufacture of marine engines and boilers, steam turbines, blowers, and other heavy mechanical devices.

At Lymburners' Plant

Lymburners Limited are just completing their American 75 mmm. shell contract, so that recent instructions affecting the general production of U.S. munitions will not be seriously felt by this company, as officials state that the entire contract will be finished in a very short time. During the past year this plant has been working exclusively on this type of shell and the average production for the past several months has been about 200,000 shells per month. About 800 men and women will be affected. Nothing definite has been decided on as to their future activities, but it is anticipated that the plant will be idle until the re-adjustment period is well advanced. Several plans have been mooted for the utilization of the plant, but no decision has been arrived at. Virtually 99 per cent. of the machine equipment adopted for shell production is of the special single purpose type adapted for shell work exclusively.

Just Getting Started

Production of the 155 mm. American shells at the plant of P. Lyall & Son will gradually taper off from now on. Forging has been stopped and the blanks now available will be machined rapidly as possible, as all operation will be discontinued before Xmas. This plant has never attained its maximum output owing to the fact that the entire enquipment had not yet been installed. No announcement has been made as to what the plant will be used for, but it is more than likely that some marine activities will be carried on owing to the fact that this firm has large shipbuilding interests now on the coast. It is possible that shipbuilding may be carried on here as the plant is idealy carried on the north shore of the St. Lawrence and adjoining the River. It is possible that some at least of the men now employed will be found employment in future activities of this firm, but temporary idleness of a great number is inevitable.

About Small Arm Contract?

In common with all other plants working on the American shells the firm of Caron Bros. will within a month discontinue the making of the 155 mm. shell upon which they have been engaged for nearly a year. A new plant had been constructed in the north end of the city and operations had almost reached the maximum. Under full operations about 1,000 men would have been employed, but this number had not been reached when the stop order had been issued. Mr. Caron stated that some complications would likely arise regarding the settlement on the part of the American Government for the work that would remain unfinished, as the work now in hand would entail considerable loss to the various manufacturers. Regarding their small arms contract for American army pistols, he stated that no advice had been received, but would not be surprised if the same ruling applied as to that for American shells.

large firm stated that they preferred to secure the material in this country, "even at a higher price."

Prices Are Dropped

Prices on sheets are put down this morning. For black No. 10, $8.50 is now quoted against $10 that has been asked for some time past. No. 28 black sheets are 25c per hundred off, selling at $8. Plates, 3-16, are marked at $8.40.

Large shipments of boiler tubes are on the way to several of the Canadian warehouses. While the lists are not handed out yet it was stated to-day that a reduction on present figures of five or ten per cent. was looked for. Dealers here can buy to much better advantage now as the makers are getting a larger supply of skelp to meet their demands. In fact several of the mills that have been out of business for the period of the war have started to roll tubes again.

The Non-Ferrous Metals.

Antimony at $16 against a previous $18 is the only drop that the local markets would admit this week. Tin is quoted locally around 85c per pound, although sales on the New York market come well under that mark.

Dealers in metals state that their trade is still quite satisfactory despite the closing down of the munitions plants. There are other lines that are in the market for material that they have not been able to secure in war days.

"We were in business before the war started, and we are in business now," was the way one of the dealers sized up the situation to-day. There is no dropping off of trade.

No doubt part of the business of the liquidation of the Imperial Munitions Board will be the disposal of some of the large properties created by it for purposes of the war. In most cases it is believed that there will be difficulty in making such arrangements, as few of the great establishments, such as that at Trenton, will be easily convertible into peace establishments, as explosive factories are never in an industrial centre, or in any centre, on account of the nature of the business.

URGES LABOR TO BE GUARDED IN ACTIONS

Tom Moore, president of the Trades and Labor Congress of Canada, has issued a letter to the trades unions, in which he announces the fact that the right-to-strike legislation of the Dominion government has been repealed, and also intimates that a representative of labor has gone to the Old Country with Premier Borden to have some part in the peace conference. Regarding the conditions in the country, under these conditions, he says:

"It is to be hoped that, with the removal of these restrictions that the unrest caused amongst the members of our affiliated organizations will subside. The best judgment and efforts of all men will be required during the future months to avoid chaos during the readjustment period of this country.

"With the cessation of war and the discontinuance of munitions manufacturing, the possibility of serious unemployment faces us. As a temporary measure, requests have been made to the Minister of Labor that all government work be placed on an eight hour day, with the forty-four hour week, and an appeal issued to other employers to do the same in order that employment can be distributed between the greatest number of workers. Other measures such as the opening up of public works and the use of day labor thereon, eliminating the contractor, and making possible the use of all grades of unemployed labor, has also been suggested to the government."

MAKERS OF PIG IRON DO NOT SEE WHERE SLUMP COMES

ALTHOUGH there has been considerable done in the way of cancellation of contracts for pig iron in the United States, there is still a very large volume of business on hand. In many cases cancellations are being refused, the idea being that it is up to the government to continue to control the situation that it brought into existence. Reports from some of the larger points in the United States give the following conditions:

Pittsburgh—The removal of all government restrictions on the shipment of iron is making it possible for the so-called less essential industries to obtain again their normal supplies of iron. A meeting of the pig iron producers of the entire country may be held soon to formulate policies for the readjustment period. Sellers of pig iron continue very optimistic as to the future and show no disposition to make price changes.

Chicago—Producers' representatives are unanimous in saying that they will accept no cancellation unless the government directs that its allocations be annulled, and to date there have been very few instances of this having been done. If allocations are cancelled it would only be fair to cancel all iron ordered for war work.

Philadelphia—Some very large tonnages are now going forward, and it appears that they have been on the books for some time, so it seems certain that there has been more 1919 buying going on in war times than was credited at the time.

Buffalo—No cancellations of any kind are reported, and one producer reports brisk inquiries for small lots, and has taken on several small orders aggregating between one and two thousand tons, foundry grades for first quarter delivery, at present prices. It is considered by many of the furnace men that the only chances for a change will be because of the coke and labor situation. With the opening of the new year it is expected that there will be plenty of business for every one.

Birmingham—Cancellations are still coming in for a considerable total. Inquiries for 1919 are still on the increase. Makers of agricultural machinery are among those who have recently placed orders. Stove works, owing to the limited supply allowed them, have a considerable amount of cast shell iron on the books that has become available, and have shown little disposition toward new buying.

St. Louis—There is no question that domestic needs are such as to keep the plants busy as they are withdrawn from government work, and there is therefore no uneasiness felt as to the continuance of activities in this district.

Cincinnati—Requests for the cancellation of foundry iron contracts with very few exceptions have been refused. Foundries in this vicinity have received a large number of hold-up orders on machine tool and other castings, and so feel justified in asking the furnaces not to crowd them with metal that cannot be used profitably. The change from war to peace work will take place without working any serious hardship.

GOVERNMENT NOT LIKELY TO ACT NOW

Will Not Take Over Any of the Property of Imperial Munitions Board

Ottawa.—Asked whether it was the intention of the Dominion government to arrange for taking over any of the property of the Imperial Munitions Board when the latter began liquidation of its business, as suggestions had been made that this should be done in connection with demobilization, Sir Thomas White, Acting Premier, said that there was no reason for doing that as none of the buildings could be regarded as suitable for the purpose.

HARD USAGE OF MUNITIONS PLANTS

Galt Manufacturer Thinks Much of the Equipment Will Have Lived Its Day

GALT, Nov. 27—Interviews with large manufacturers of munitions indicate that wherever possible an effort will be made to utilize in peace work the machinery which for some time has been producing munitions.

R. W. Roelofson, of the Roelofson Machine & Tool Co., stated that the machinery they have been using for the production of munitions will not be scrapped. Their plans are not yet fully developed, but they confidently expect to find some means of putting this machinery to good use in other lines.

A. R. Goldie, of the Goldie & McCulloch Co., stated that he did not know yet what would be done with their munition machinery, and said the question was one that was hard to decide and one on which he himself would like a little advice.

"Long runs and unskilled help have used up munition machinery more than would otherwise have been the case," said W. D. Sheldon, of Sheldons Ltd. He stated that the newer machines would be used, if possible, in other lines, but those which have been in operation for any length of time would most likely be found to have out-lived their usefulness.

CAN'T FIGURE OUT HOW THERE WILL BE A SLUMP IN WAGES

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Dec. 5.—Events as to "reconstruction" are moving rather rapidly. Reconstruction work itself is not formidable in character, for it is found to consist chiefly in ceasing to do the things that were being done as war measures, while industry is showing a strong disposition to reconstruct itself.

There is now good reason to suspect that recent talk of reconstruction was indulged in largely for its sentimental effect. For instance, at the outset it was on all hands considered imperative that the War Industries Board should continue to fix iron and steel prices, and there was much talk of the desirability of its fixing minimum prices instead of naming its prices as maximum, as formerly. The idea was that the iron and steel market was clearly booked for a great slump, and needed support for a while. The talk of fixing minimum prices was soon dropped, as it was seen clearly that nothing of the sort could possibly be done. Now there has been such further progress that it seems unlikely that the War Industries Board will set any prices at all. The present limits expire December 31, for they were as usual set to control deliveries to the end of the quarter. The board has intimated that it will fix prices only upon definite request of an industry involved, also that it will do so only in a case of emergency.

Control Relaxing

It looks now as if industry would be fairly well able to reconstruct itself, and that may be the reason why every day there is fresh news of the Government relaxing its control. It is not safe, however, to assume that it is positively settled such is the case. The relaxation of control may be due in part to the War Industries Board recognizing that the continuance of control would be difficult. Thus at the end of November the board ceased the making of allocations, announcing that thereafter the various "purchasing agencies" would make their purchases direct, the War and Navy departments, for instance, as well as the Fleet Corporation, the Railroad Administration and the purchasing commissions of the Allied Governments. Whether the initiative in this move came from the board or the buyers involved is not known. What is clear is that the authority of the board in the matter of prices is greatly reduced. Hitherto when it set maximum prices it made no particular effort to shade the prices, but placed the orders for the various requirements at the maximum limit. In future the condition would be that of the board fixing maximum limits and of the various agencies being free to seek to buy at lower prices than the limits. That they would seek to shade the limits is obvious.

Producers More Confident

Producers are showing more confidence in the price future. They do not expect the market to decline as much as they did a few weeks ago. Some blast furnace interests, though not all, venture to predict that if the pig iron market is left to itself it will advance. They claim that pig iron is stronger than steel, because in the past three years there has been more new construction of steel making capacity than of pig iron making capacity. It is true the steel works were fairly well supplied with pig iron during the war, but the foundries were not taking their usual proportion, and it would perhaps be difficult to find enough pig iron to operate all the steel works and foundries at capacity. Then it is claimed that Great Britain and France want large tonnages of pig iron, 750,000 tons being mentioned in the case of Great Britain.

The Matter of Wages

A question that has been much discussed, in connection with the future of iron and steel prices, is that of wages. It is understood that the Government does not desire to see any wage reductions and so the argument has been made that if the Government wants wage reductions to be avoided it should endeavor to sustain the market. Some criticism has been directed against the Government's policy of going slow in the matter of cancelling contracts for war steel, and what is back of the criticism is undoubtedly a desire to see conditions brought about in which wage reductions might be effected. In the last analysis, however, it is improbable that heavy wage reductions could be made. The steel mills are even now short of labor and the world's real work for the peace period has not begun. Furthermore, the iron and steel industry has in the past depended largely upon immigrant labor, and immigration has been shut off for more than four years, while prospects now are that instead of immigration there will be emigration of some of the foreign born. A great many men have signified their intention of going abroad as soon as they can secure passage. If half as many go as now think they want to go there will be a serious shortage of the class of labor upon which the coke works, blast furnace and steel mills depend. To attract American born labor in sufficient volume to make up the deficit might require further wage advances and the introduction of the eight-hour day. Steel mill labor works chiefly eight, ten and twelve hours, unskilled labor being almost entirely ten and twelve hour. Since the wage advance of last August the standard rate for common labor has been about 42 cents an hour. With the introduction October 1 of "the eight-hour basic day" the ten-hour men get paid for 11 hours and the 12-hour men are paid for 14 hours, receiving time and a half after the eight hours. At 42 cents the 14 hours is $5.88 per day, and an actual eight-hour day might be impossible at a 42-cent rate, which would make only $4.20. It must be accepted as positive, at any rate, that there is not going to be any great reduction in the wage cost of mining ore and making coke, pig iron and steel, except as some reduction occurs through men rendering better service than of late. Steel prices cannot possibly decline to the pre-war level.

The new demand for pig iron and steel is not heavy by any means. It is insistent, but is only for relatively small lots and for early deliveries. The market certainly has not struck its gait yet for there is none of the heavy buying for construction work, for "investment" purposes that is always essential to give the market full support and employ the industry at capacity. Even that part of the Government demand that is to be counted upon for the future is not much in evidence. The Railroad Administration shows no disposition to place orders for rails, cars or locomotives at this time. The Fleet Corporation has suspended some plate contracts, on the ground that the plans are being changed so that fewer small vessels and more large vessels will be built, and new specifications will be filed later against the revised program.

Predictions are of course very hazardous, but the balance of probability seems to be that something like the following will occur:

Present maximum limits for pig iron and steel products, set to cover deliveries through December 31 to continue to be observed, without the War Industries Board taking any action as to the later period; producers to endeavor to have buyers take out as much tonnage as possible of their present commitments, then to reduce prices to a level that will tempt buying as investors get ready to take hold, probably some time in the early spring, new buying being confined meanwhile to the filling of pressing requirements, against which buyers cannot afford to wait. The chief doubt is whether there will be a slump in the market, with a quick recovery, or a gradual settling to a regular trading basis on which the market will sustain itself. It goes without saying that eventually there will be heavy demand; if there is not, 90 or 95 per cent. of the trade is now laboring under a great error.

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	4 55
Steel bars, base, Montreal	5 05
Reinforcing bars, base	4 50
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Brand steel, No. 10 gauge, base	5 05
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 31 00	$ 29 50
Electro copper	31 00	29 50
Castings, copper	29 50	28 50
Tin	83 00	88 00
Spelter	10 50	11 00
Lead	10 50	10 00
Antimony	12 00	16 00
Aluminum	46 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 8 00	$ 8 00
Plates, 3-16 in.	8 50	8 40

WROUGHT PIPE

Price List No. 37

Standard Buttweld

Per 100 feet	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$15 00	$20 00
Copper, crucible	18 50	24 50
Copper, heavy	18 50	24 50
Copper, wire	18 50	24 00
No. 1 machine composition	19 00	22 00
New brass cuttings	10 00	15 50
Red brass turnings	13 00	18 00
Yellow brass turnings	9 00	13 00
Light brass	7 00	9 50
Medium brass	9 00	12 00
Heavy melting steel	20 00	22 00
Shell turnings	9 00	12 00
Boiler plate	21 00	20 00
Axles, wrought iron	32 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	30 00	33 00
Malleable scrap	25 00	20 00
Pipe wrought	18 00	17 00
Car wheels	38 00	30 00
Steel axles	34 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	22 00	19 00
Cast boring	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	6 00	8 00
Tea lead	5 50	5 75
Aluminum	16 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 32
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

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

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 60%

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	$ 8 00	$ 8 00
Sheets, black, No. 10	10 00	8 50
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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.	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B. ⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	.26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod.	0 38
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

Colored.

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

Wool Packing.

Arrow	25	Anvil	16
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	48 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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	...
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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EDITORIAL CONTENTS

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Automotive Repair Work in the Machine Shop

Here Are a Number of Things That the Man in the Repair Shop Should Know—The Working Parts Are Very Crowded and Special Methods Are Frequently Needed to Gain the Results

By DONALD A. HAMPSON.

MACHINE shops in the repair field have naturally benfited from the widespread use of gasoline engines, particularly from the automobile. And this is not going to lessen in the future with the return to peaceful occupations and with the prospect of labor shortage for some years to come. What follows in this article applies to the automobile, but the tractor, the truck, and the stationary engine would present the same problem under like conditions—the methods applying to the one suggest other (possibly better) methods that may be used to suit particular types of construction.

Naturally most of the repair business goes to the garages. There are some garages that possess a full complement of tools and appliances, that have good machinists capable of getting the most out of such equipment, but the average garage is and should be a service station, making running repairs only. It is the writer's conviction that there should be a distinct line drawn between strictly service-and-adjustments and the work of the machinist and that this line should be maintained even in the fully equipped garage. The machinist should possess a full machine shop training, including metal working, hand and machine, blacksmithing and tool experience. The garage "machinist" does many of the things included in the above, but because he is not grounded in the theory and practice of the art of metals he cannot be expected to do or to know the how and why of all that goes to make up such a machine as the automobile—the electrical equipment, motor and carburetor adjustments, road work and repairs constituting a field that will take the most ambitious man years to master in its entirety.

It is because garage owners have not recognized the great distinction between these fields of mechanical endeavor that garages as repair shops have come into the disrepute that amounts to little else than a black eye. When machinists work specified hours, do not have to be called away for a nice fitting job to take off a tourist's muddy front wheel, and the entire force gets educated to the idea that cigarettes have no place in the day's work—then and not until then will the stigma be removed from the garage business.

Many garages do not pretend to have machine shop facilities and are the gainers by such practice; to the customer who looks askance when he learns they haven't a lathe in the garage, it is reassuring to say, "We send our machine work to Wilson & Wood's—they do the best work in town and we have special arrangements with them to get our jobs out promptly, far more so than if we had only one man around who could do such work." This arouses the customer's interest and if he does not know W. & W. he enquires and he finds they have a large shop, more machinery than a dozen "fully equipped" garages, and their men are noted for skill and honesty. A plan that has worked well for all is for a machine shop to go to a number of garages and solicit their machine work and repairs, the garages agreeing not to put in any tools and the machine shop agreeing not to give "service" or to do overhauling; when such arrangements are made and the machine shop is worthy the name, the results are mutually beneficial and the community soon places confidence in the automotive repair men.

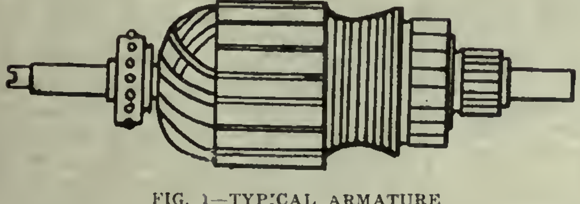


FIG. 1—TYPICAL ARMATURE

SLOTTED COMMUTATOR

SLOTTING TOOL

There is found in the modern automobile such a variety of metals in different states and the constructions are so ingenious (often so crowded), that the skill of the machinist is taxed to the limit while his interest is kept always to the point of freshness. Add to this the prodding finger of the job wanted in a hurry and you describe a field of labor to attract the most blasé. Machine shops doing repair work have a life-long experience on parts that must stand up for years and that must pass the inspection of experienced men—to them the turning out of dependable work for automobiles is but a habit extended in another direction, to which must be added the sobering thought that human life hangs on the integrity of their work.

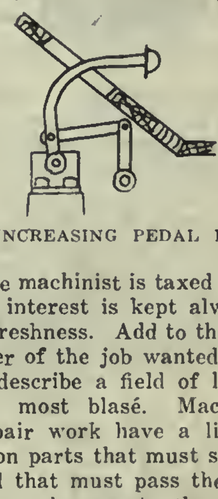


FIG. 2—INCREASING PEDAL LEVERAGE

A number of interesting repair jobs will be described and illustrated. There may be other and better ways to do each—if so, they should be brought to light for the benefit of repair men and the broadening effect of interchange of ideas—but each job has been satisfactorily done as related.

Turning Commutators

A typical armature (Delco) is shown by the drawing Fig. 1. If watched and sandpapered occasionally it will not be necessary to turn the commutators for a long time, but neglect will cause much electrical trouble and necessitate turning off a considerable amount of the copper bars. The smaller commutator gets most

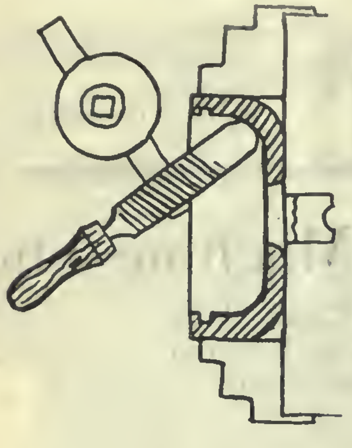


FIG. 3—HAND FINISHING BALL RACES

wear. As the brushes are not the full width of the bars, a shallow neck may be turned as shown—it makes a better looking job and assists in cleaning out the mica. Cutting the mica insulation down a thirty-second lower than the copper surface is a great help toward long life and freedom from troubles electrical.

The quickest way to remove this mica is to cut it out with a hack saw fitted

FIG. 4—BRAKE ROD REPAIR

with a handle as shown. If the mica is cut before the commutator is turned, a slip of the saw does not scratch a finished surface—if the commutator has been so slotted before, the saw merely deepens the old cut; if it has not, the best way to start the saw cuts is to notch the mica all around with a three-cornered file before slotting. The turned clearance is of great assistance in slotting. Either a blade wide enough should be used or the first cut followed by a second partial

FIG. 5 IMPROVED WAY TO INSERT COTTER

cut to cut out the full width of mica and brighten the copper sides (any mica remaining dirties the brushes). Street railway companies have special machines rigged up to slot their motor commutators.

As is well known a fine pointed tool is used for turning—and a fine feed accompanies. Sandpaper (only) is used to polish if the tool cut is not smooth enough. If a dull tool is used, nothing but a torn cut can be made—a commutator may be ruined by a tool so wide or so dull that it gouges the bars. With the right kind of a tool, a smooth cut is obtained on the narrowest of bars and with the mica backing already removed. The large commutator seldom needs more than a light sandpapering; its bars are wide—19 against 38 in the small commutator on this Delco—and the brushes less wearing. The machinist of experience sees to it that the centers are true before he turns and that there are no imbedded copper chips after he is through to cause a short circuit.

Making an Easier Working Clutch

The sale of a car hinged upon the question of whether the clutch could be made easier working or not. The customer was a man of importance in the community, also he had a "bum knee." After the garage people had freed up the adjustment to the slip point and had removed joint friction all without helping the trouble, the machine shop was consulted. Viewed from their angle it was found that of the five inches pedal movement but one and one-half inches were actually needed to release the clutch. Then the draftsman took some measurements and roughly laid out the change of Fig. 2.

The old pedal was cut off so as to be entirely under the floor board. A new pedal took its place as the foot "connection" and though it traveled through a different arc, it mattered not to the customer because he wasn't familiar with the original one. A stud set in a piece of steel angle supplied the pivot for the new pedal, the angle fastened by using longer bolts through the sub-frame. With this arrangement nearly all of the five inches movement was utilized in releasing the clutch. Taking advantage of the fact that most drivers shove the pedal clear to the floor, this increased leverage made the clutch so easy as to be perfectly acceptable.

Finishing Ball Races

Once in a while circumstances force the making of a ball cup or cone in the machine shop. Because of the uncertainty in hardening and the meagre grinding facilities, such work is avoided when possible. Usually the concave surfaces have to be left as turned—therefore they should be very smooth and nicely rounded. After turning with a tool, a hand tool is excellent to finish the contour more perfectly and to smooth down. If coated with blue and a ball held against the revolving piece, the high spots are located — then the hand tool resting on a piece in the tool post is used to scrape the surface down for another trial. This method gives better results than any other possible with ordinary equipment. The hand tool may be made from an old file which before rehardening is shaped relatively close to the curve of the ball.

Brake Rod Repairs

Brake rods frequently snap in two, the break occurring about in the middle of their length where the "slap" is greatest and being very nearly square across. The usual repair is by a weld. Some people are opposed to a weld in so vital a part; also at times there is no one at hand who can make a good weld—a weldless repair is made as follows:

Cut a thread on each of the broken ends. Usually this will be 5/1" or ⅜ x 24. Get a piece of steel ½" or larger, drill and tap clear through with the corresponding tap. This piece should be not less than 1" long and may be hexagon or round. Screw both ends of the rod into the nut until they butt and the rod is the same length as in the original and all ready for service. Such a repair is quickly made—it necessitates no re-adjusting of the brakes. As the length of such rods is several feet they get much

FIG. 6
WHERE TO CUT OUT. IN POSITION.

vibration, a cause that may be remedied by fastening a light coil spring between the floor boards and the middle of the rod with the result that the rod is constantly snubbed, but its normal function is not interfered with in the least.

Needle Valve Work

Carburetor needle valves need occasional attention. If grinding is necessary, pumice stone should be used in powder form. Ford owners who have tried it report greatly decreased gasoline consumption from a change in shape of the pointed valve end. If the point is filed to give a lesser included angle, this economy is noted. A precision lathe or a small lathe and chuck in first class condition are necessary for needle valve work.

A Kink for Castellated Nuts

A castellated nut seldom lines up with the pin hole when the nut is tightened "just right." Common practice is to set up a little tighter, making the bearing too snug and perhaps straining the bolt or else to slack back to the next hole, when the bearing is too loose. On the best work the nut is taken off and the face carefully filed an amount (determined by trial) that will let it turn up about another twelfth of a revolution, which will bring slots in line with pin hole when the bearing fits as it should be.

Inserting Cotters in Unseen Holes

We have cotter pin extractors and a few inserters on the market, but the latter are not of assistance in crowded quarters and for unseen holes. For general work and particularly for these holes that must be felt and not seen, the kink shown by Fig. 5 is invaluable. Instead of inserting the cotter flat against the shoulder, it should be turned at right angles. This brings one leg against the work and the other springing outward where it is convenient to the finger for closing. A maximum of finger room is thus afforded, a sharp contrast to the conventional method where fingers should possess tweezer properties in addition to the sense of touch.

Quick Way of Making Thrust Washers

Special washers, or collars, are often wanted to back up gears after adjustments. Some shops make them from a round piece of steel, chucking the piece, drilling, and cutting off to the required thickness. A simpler way is to make up the space with one or more washers of standard thickness cut from flat cold drawn steel. Thus if a space of 7/32" was to be filled, it would be done by one washer each of ⅛", 1/16" and 1/32" thickness or other combination according to the steel at hand. A dollar's worth of steel of thicknesses under an eighth would make dozens of washers for rear end work—an unskilled man can make good washers that way as well as an experienced lathe hand can make the single piece kind.

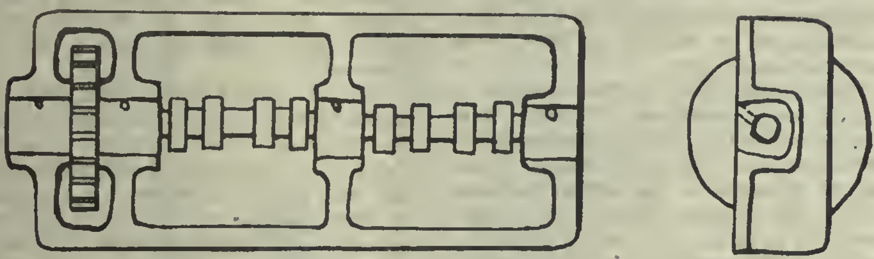


FIG. 6—BABBITTING BLIND BEARINGS

New Rings for Worn Cylinders

The writer prefers the straight lapped rings for worn cylinders instead of those diagonally cut. With the latter there is of necessity a leaking space provided if the rings are not fitted tight together at the ends, and if this is done there is danger of rings being so tight as to score. With the straight lap, the rings could take up a sixteenth of an inch difference in circumference (if it were there) at different parts of the bore and still there would be no crack exposed for compression to leak past. And it is as easy to cut the rings that way as on the angle as shown by Fig. 6.

A Blind Construction and its Repair

A certain well known make of popular priced cars has a removable side plate for the cran case and this "plate" carries the cam shaft in four babbitt bearings, the two at the front end enclosing the timing gear as shown in Fig. 7. There is no means whatever for taking up wear in the bearings, though that may not be necessary in the normal life of the car and need not be considered. But when the timing gear needs to be replaced "you are hurt," in shop vernacular, for the babbitt bearings are not renewable linings but are cast in the side plate which is provided with liberal anchors to keep the babbitt in place. Broken and worn gears do have to be replaced. What to do to avoid re-aligning and pouring after the entire shaft and bearings have been removed has puzzled many a workman.

Instead of taking out all the babbitt at each bearing, it can be carefully chipped and sawed down to the center line of the shaft, when the latter may be lifted out. The gear is then changed and ready to go back. If the pockets for babbitt are carefully cleaned and the anchor holes drilled out and the "parting line" filed down smooth with all swells and burrs taken off the bearing surface, the shaft may be laid back in its original position. Then the pockets are blocked up in the usual way and the upper half of the bearings poured. The anchor holes effectually keep the new metal in place.

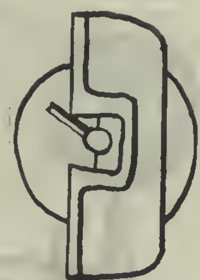


FIG. 7 WORK ON A BLIND BABBITTED CONSTRUCTION.

It is possible to make a first class job in this way, a running fit in spite of the fact that the shaft cannot be taken out for reaming or scraping of the bearings. A coating of red lead or of graphite mixed with oil will leave the babbitt running fit but not too loose. For the oil holes in each bearing, pieces of wood or of 3/16" rod are put in the mould before pouring and supported at the right angle by putty; these are withdrawn after the babbitt solidifies, leaving a clean hole right up to the shaft. Such a process makes a short job of what appears to be hopeless case in the beginning.

Increasing the Size of Cast Iron Parts

If cast iron is heated to a red and kept at that temperature for some time its size is permanently increased. The increase is only a matter of a fraction of an inch—usually but a few thousandths—but this is often enough to permit a light cut over a part and still leave it larger than it was originally, thus saving a worn part like a piston and getting that much more wear from it. An hour's heating will produce a measurable increase in the size of a worn piston casting.

Reaming Undersize in Cast Iron

There are several well known methods for making a reamer cut larger than itself—but rarely do we hear of any way to make it cut smaller, except the one to wait until the reamer wears. But when a hole is wanted one or two thousandths small and the material to be cut is cast iron, this can be done by the use of oil during the operation. Cast iron is always reamed dry, but this trick will make even a sharp new reamer cut a shade small and with a reamer slightly dull, the oil will produce a hole noticeably smaller. In fitting wrist pins, this is a time and labor saver.

A Tool for Enlarging Holes

The need for some sort of a tool other than a file for enlarging holes is feln almost daily in the repair shop. Sometimes it is a job in the vise, sometimes it is a job on a car on the floor—usually the work is not particular, often it is desired to enlarge an eighth of an inch or thereabouts. If there is a railroad shop in the vicinity get the boilermaker to save an old boiler reamer for you. These are long taper reamers, a typical size being about ¾" and 1¼" at the ends and 15" long. They are sharpened until the flutes are nearly gone and in the course of use may acquire some broken teeth, but they are tough and very useful when a hole needs to be enlarged, as, for instance, a hole in the side frame of an automobile. Enlarging such a hole with any sort of a breast drill is mean, catchy work, but the taper reamer will do it quickly and easily. And the taper is so slight as to be negligible

Before Buying a Gas Saver

Machinists on automobile work are frequently asked their opinion of the saving effects of one of the gas mixers advertised to break up the mixture of air and gas before it gets to the cylinder. For less than a dollar one may try this out before buying.

If a ¼" pipe tap is put in the "Y" of the intake and a pet cock inserted, the effect of more air can be noted—and this comes pretty near to giving the result obtained by the patented articles though it is not automatic or convenient to regulate when driving. However, if it does no good the cock may be left closed and everything is as before—if it does show a betterment, the hole is all ready for the mixer which usually attaches at that place.

Saving Time With New Ring Gears

Before riveting on a new master gear to the spider, it is a good plan to put the latter in the lathe and check the seat where the ring goes. Often an unsuspected high or low spot or a bend will show up which if unnoticed would cause the gear to run out and be the real source of much trouble and noise, hunted for in vain.

Two Items of Equipment

The shop that has city gas service cannot afford to get along without a bunsen burner fitted to at least one jet. These burners produce a hot blue flame that does not leave any soot; they can be bought of the gas company, who will make any change required to give the right kind of a flame for particular conditions. The gas flame makes the finest kind of a medium for drawing the temper on hardened parts, for tempering small tools, for annealing wire, bending springs, and a hundred other jobs requiring a clean, hot flame instantly available.

City gas is useful in another way. We are told that gasoline conservation demands other methods of cleaning automobile parts than washing in gasoline and that soda is the right thing to use. But soda requires heat and a convenient, clean heat supply is not always at hand. It will pay to rig up a soda cleaning outfit—the cost is really very slight. An ordinary gas stove burner is inexpensive and so is a good sized iron kettle for the soda and the work. For safety and neatness these should be surrounded by a metal cylinder which may be a section of an old hot water tank—with it, a couple of cross pieces can be put in which will take the weight off the burner. With this self-contained outfit, all the grease may be boiled off small parts and gears at little expense and the fire can be started any time with no trouble.

SHAFTING QUICK TO CATCH CLOTHING

Great Care is Always Necessary to Guard Against Any Accidents.

By J. H. R.

The statement that an oiler employed at the Hochelaga power plant of Montreal Tramways Co. was recently killed by being swung around a driving shaft and dashed to the concrete floor, only emphasizes the fact that the greatest precaution must be continually exercised when men working in close proximity to rapidly moving shafts or machinery. The presence of oil on a revolving shaft is always an attractive force for loose parts of clothing, and little warning can be given when a shaft takes hold of some portion of the wearing apparel.

We would recall a instance where the driving shaft of a geared draw press was located at the rear of the machine, at a height of about five feet from the floor. When setting or repairing draw dies it was frequently necessary to stoop beneath this shaft to reach the work, and the writer himself has had cause to remember this shaft, as it has been the means of pulling a few odd hairs out of a well cropped head. Chances should never be taken where risk is imminent. Play safe.

METAL HARDNESS TESTERS

By F. C. P.

THE accompanying illustration, Fig. 1, shows a metal hardness testing machine of the hydraulic type, developed at Pittsburgh, Pa., while Fig. 2 shows another type of hardness tester of Waldo type using plummet weighing one pound and falling one foot to the surface of the material whose hardness is to be measured.

In the drawing Fig. 3 may be noted the details of construction of a microscope designed to read Ball Test Impressions, as utilized in connection with the hydraulic testinb machine on the Brinell principles for determining hardness of metal, as developed by Eimer & Amend.

It may be of interest to consider the construction and operation of these hardness testers, as utilized in various industrial laboratories.

For the inspection of the hardness of metals under conditions of service, various instruments have been proposed by physicists and engineers, whose fundamental principle is the actual deformation of the material tested, by a uniform blow. It is claimed by some that instruments which measure the skin elasticity of materials rather than an absolute deformation of their surfaces, have found less favor with engineers and are usually limited to inspection of material of identical chemical constitution and uniform working. Instruments which actually deform the surface are usually limited to laboratory installations and are heavy though leaving little to be desired on account of their accuracy, certainty of duplicating results and facility of use.

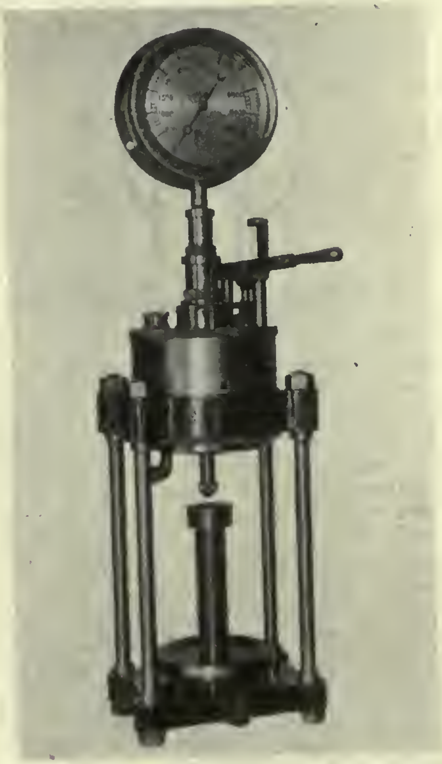


FIG. 1—HYDRAULIC HARDNESS TESTER

The instrument the writer describes, noted in Fig. 2, consists essentially of a plummet weighing one-tenth of one pound avd., and falling one foot to the surface of the material whose hardness is to be measured. This plummet has a conical, replaceable, chill-tempered, 60 degree, steel point.

It will be seen that this plummet has tied to its upper extremity a very thin silk thread which bends over a funnel-shaped end piece, into which slotted holes are cut with burnished edges so that the silk thread passes through them with practically no friction loss. The funnel turns with a slight friction in the end of the jointed supporting brass tube. The silk thread is attached to a small burnished ring at its lower end, which ring in turn is caught in a little trigger, which can be released by a thumb screw without jarring the instrument.

The silk thread then passes from the release catch through the holes so that the plummet point is exactly over the aperture in the base of the instrument. The base of the instrument is supported on three points, two of which are controlled by a levelling screw and small cross levels indicate the verticality of the supporting rod.

When in use, the instrument is set on the surface of the material whose hardness is to be tested, so that the aperture in its base is concentric with the exact spot to be tested. The plummet is then hung as shown, and lowered by holding the silk thread by its ring between the fingers so that the exact position of the clamp may be found for insuring the vertical fall of the plummet. This being determined, with the instrument levelled. the thread ring is placed in its releasing trigger and with the plummet in position the funnel support is gently turned until the distance from the conical point to the surface of the material to be tested is exactly one foot. The instrument is now ready for use.

A convenient way of stopping any slight swinging motion of the conical point is to touch it gently with a small camel's hair brush or a piece of cotton wool. The instant the plummet is still the trigger is released by the thumbscrew, and the plummet falls, making a uniform circular indentation in the material tested. The object in releasing the plummet from the bottom of the apparatus, is to avoid any disturbance in its upper support. The entire operation consumes but a few seconds after a slight experience with the instrument.

The small portable microscope noted in Fig. 2 then replaces the plummet apparatus. This microscope is designed so that it has sufficient illumination and magnifying power to measure easily with an eye-piece micrometer the diameter of the impression made by the falling plum met point. The average diameter of the circular depression is then measured Scale for measuring indentations is embodied in the microscope.

Many consider the Brinell method of testing the hardness of metals as the best method. A hardened steel ball is pressed into the smooth surface of the metal so as to make an indentation which is then measured with the aid of a microscope. The Brinell Ball Test may be applied to unfinished material as well as to manufactured goods, such as rails, armor plates, guns, projectiles, automo-

FIG. 2—PLUMMET HARDNESS TESTER

bile springs and structural materials.

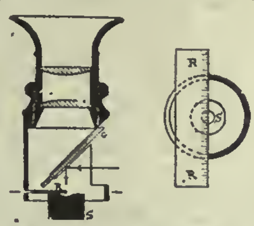
It will ascertain the effects of annealing and hardening of steel and serves as a basis for calculating the tensile strength directly from the results of the hardness test. Another factor in the Brinell method is the ability to measure the power of resistance of various metals to continuous pressure. For practical purposes the tensile strength can be assumed to be one-third of the hardness number in metric units; or the hardness numerals can be multiplied by the coefficient of 0.346 as a uniform constant and the result obtained will be the ultimate tensile strength of the material in kilograms per square millimeter. To convert kgms. per sq. mm. to pounds per square inch, multiply by the factor 1422.3.

The hardness tester shown in Fig. 1 has four supporting columns, but the Eimer & Amend machine is of the heavy goose-neck style. By the use of the controlling weights wrong readings are entirely excluded. If the manometer should get out of order this device will show the error. The main parts of the testing machine are: The Hydraulic Press, the Hand Pump and the Pressure Gauge with the attachment for the controlling weights.

In order to fill the machine with oil, care is taken to remove all air. To do this the gauge is left off and the pump used till the clear liquid shows where the gauge is to be screwed on. The latter s filled with oil before shipment is made. If the pump, piping, press or gauge contain air, the gauge hand will travel up and down, and the pump lever has a tendency to rise. The gauge hand will remain in any position if the machine is free of air. The machine utilizes 10 mm. steel balls and a microscope, and hardness number schedule.

As noted in drawing Fig. 3, the microscope used is especially constructed to real Ball Test Impressions. The reflector G furnishes a strong illumination for the test pieces, and with the aid of the small steel rule R fitted in the bottom of the cylinder the exact diameter can be very easily read to 1-10 of a millimeter. The instrument can also be used where accurate measurement of small distances is required, and by removing the glass reflector and steel scale the magnifier may be used as an ordinary focusing glass.

The test piece must be perfectly plane and even on the spot where the impression is to be made. It is then placed on the press table and brought in contact with the ball. Then it is only necessary to close the valve and with about ten strokes of the hand pump a pressure of 3,000 kilograms (6,614 pds.) is produced. Iron and steel are subjected to this pressure for ¼ minute, softer material for about ½ minute. After this time the valve is opened, the oil re-enters the reservoir and releases the test piece. The diameter of the impression is then measured with the aid of a microscope by which an accuracy of 1-10 mm. can be obtained, and now the corresponding



MICROSCOPE FOR READING INDENTATION IN DETERMINING HARDNESS

table furnished. The small quantity of hardness number is looked for in the oil which may leak through the press cylinder collects in a cup and is periodically returned to the cylinder.

SHIPPING DEVELOPMENTS AT BELFAST

Definite and most interesting information as to the shipbuilding developments, now under way at Belfast, was communicated by the chairman of the Belfast Harbor Board at one of its recent meetings. During the past year about 150 acres of the harbor estate on both sides of the river Lagan have been let to the local shipbuilding firms, representing almost a doubling of the area presently devoted to shipbuilding and marine engineering. About 124 acres have been let to Messrs. Harland and Wolff, Ltd., and 24 acres to Messrs. Workman. Clark & Co., Ltd. On an area of 85 acres of recently reclaimed land on the east side of the Musgrave Channel, Messrs. Harland and Wolff's contractors are now laying out a new shipyard, erecting workshops, and the necessary overhead equipment. The water frontage is over 900 ft., and there is accommodation for six building berths on which it will be possible to construct vessels up to and over 1,000 ft. On another area of 40 acres, situate between Musgrave Channel and Queen's Road, the same firm intend laying down premises for engineering purposes. Messrs. Workman, Clark & Co., have acquired 24 acres for extensions to their North Shipbuilding Yard supplementary to their extension carried out about five years ago, in which the firm then laid down two building berths, and to utilize the rear portion of the new ground in various ways necessary to the carrying on of a shipbuilding business. The firm has a present twelve building berths, five of which are in the south yard on the Co. Down side, which is undergoing reorganization. Side by side with this private enterprise, the Harbor Commissioners are embarking on a most extensive scheme of harbor works, including wharves and jetty quays, deepening of channels, etc., the carrying out of which will be spread over a considerable number of years. Parliamentary powers, involving an expenditure of 2½ million pounds on these works, which also include the construction of a new graving dock, 975 ft. long, and an entrance width of 111 ft., have been obtained during the present session.

THE LARGEST MOTOR BOAT

The largest and most powerful motor ship yet produced anywhere was, in September, put through her speed trials on the Clyde. This is the twin-screw Deisel-engined "Glenapp," of 10,000 tons deadweight carrying capacity, and 6,600 total engine power, developed in two sets of eight-cylinder, four-cycle Burmeister and Wain (Diesel) Oil Engine Co., Glasgow. The vessel herself was built by Messrs. Barclay, Curle and Co., Whiteinch, who previously were associated with the Burmeister and Wain works, and were pioneers in Great Britain in the matter of motor ships. All the engine room auxiliaries of the Glenapp, also all deck machinery. including the steering gear, are electrically driven. the power being generated by two auxiliary Diesel sets in the engine room. A small oil-fuel boiler supplies steam for heating and cooking systems, and for fire-extinguishing purposes. The oil-fuel is carried in the vessel's double bottom, the space generally occupied by side and cross coal bunkers being thus available for cargo. It may be added that Messrs. Barclay, Curle & Co., Ltd., during September, and within a period of ten days, delivered to their owners two merchant steamers of a total deadweight carrying capacity of 20,000 tons.

Halifax.—A contract has been given the Halifax Shipyards, Ltd.. for the building of two 10,500 tons d.w. steel steamers. The price paid is $197.50 per long ton d.w. The vessels are to be built to British B.O.T. Canadian Steamship Inspection, and Lloyd's requirements.

Notes on the Computing of Gauge Tolerances

This Article is Based on Practical Accomplishments and is Applicable to Every-Day Practice—Rules Are Given For the Computing of Allowable Tolerance For Various Gauges

By M. H. POTTER

IN considering the design of gauges it must be borne in mind that they are the direct opposite of the cutting tool. The tool removes stock and leaves a surface. The gauges perform no work themselves but check work already done.

The tool does only one thing; the gauges must oversee everything and overlook nothing.

As one weak link may break a long chain, so in manufacturing a complicated, interchangeable part, any operation not completely controlled by its gauges may utetrly disrupt production or cause interminable delay in getting started.

The following are some of the more frequent troubles experienced with gauges:

1. Each individual gauge must tell a true story. If it is to be used by inexperienced girl inspectors it must also be as near foolproof as possible. Many gauges give a false reading by attempting to cover too many points, particularly on the "no go" end.

hole within these limits will accept the "go" and refuse the "no go" end, and so also may an oblong hole, a diamond-shaped, or even, in an extreme case, a round hole, which is absurd.

Much better gauges for this purpose are a double-ended width gauge and a single-ended square plug, such as gauges width gauge has on one end the maximum size, and, if it enters, the hole is then at least large enough. The thin width gauge has one one end the maximum distance between opposite sides of the square. If this will not enter, then the hole is not too large in any one dimension, and consequently is acceptable. The "go" end of the width gauge is used when the square plug will not enter, and indicates which dimensions are below size, or whether the plug is hanging up on corners, etc.

The "no go" part of a gauge should check only one dimension. When it attempts to check more than one it is evident that should any one of the several dimensions be correct, the part would

assigned and yet be troublesome at a later point when assembling. If each gauge tells a true story and the tolerances are properly computed, then a careful investigation will usually show that at least one operation is not completely controlled by its gauges.

A case of this kind is a part similar to Fig. 2, having several dimensions, each of which is given definite limits. When these dimensions are gauged separately it is possible for every one of them to be within the prescribed limits, and yet for the part to give trouble at assembling. In this particular case a combination gauge similar to the part with which this must assemble will assure that a part meet this combination gauge and having each of its dimensions within the given tolerances will be satisfactory.

Examples of incomplete gauging are innumerable. Bar stock cut to proper length for machining will not clean up unless the ends are square, yet how much labor and material has been lost because

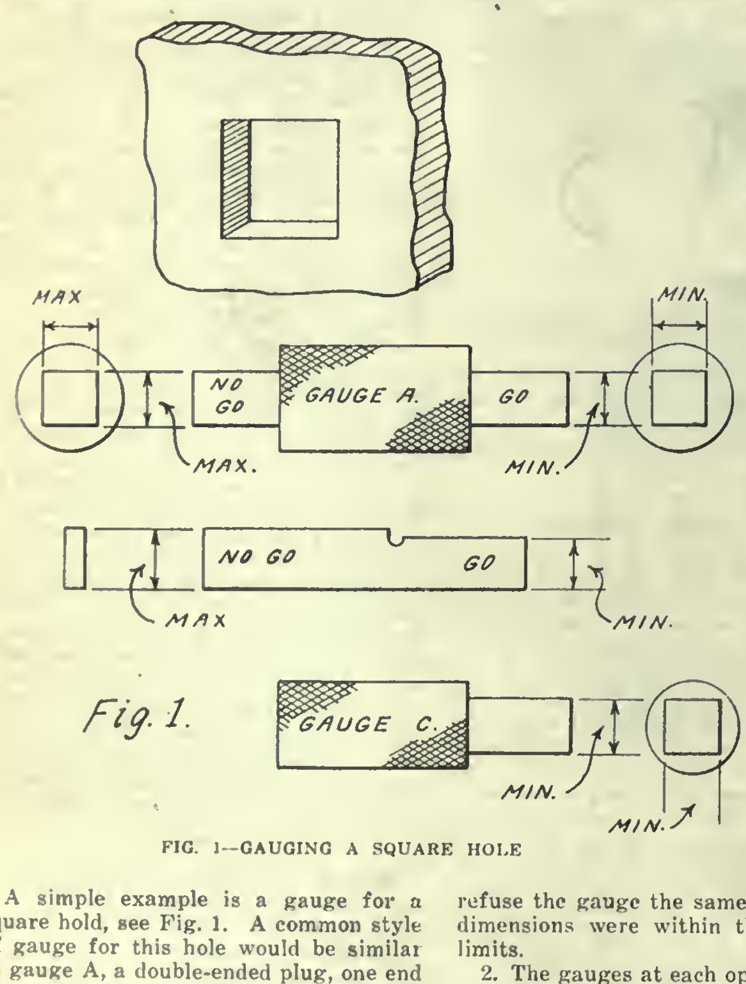
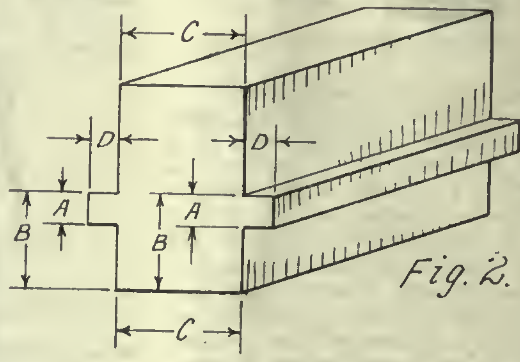


FIG. 1—GAUGING A SQUARE HOLE



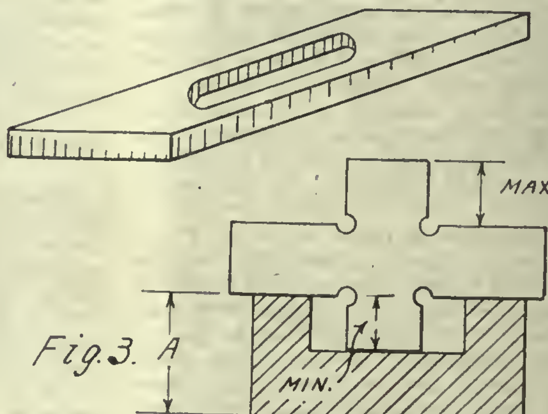


FIG. 3—DEPTH GAUGE

A simple example is a gauge for a square hold, see Fig. 1. A common style of gauge for this hole would be similar to gauge A, a double-ended plug, one end having the minimum and the other the maximum size of the hole. A square

refuse the gauge the same as though all dimensions were within the established limits.

2. The gauges at each operation should tell the whole story. Under certain conditions parts may meet all the gauges

the cutting off was done to a length gauge and not to a square gauge.

In drilling holes throug material of any considerable thickness, both ends of the holes must be checked, for though the holes may start properly they are liable to be out of location when they get through to the other side. If both ends are gauged the operator will learn to control the cut or get another job.

Errors of this nature are perhaps the most persistent and vexatious experienced in manufacturing interchangeable parts. They are errors of omission rather than of commission, and therefore extremely difficult to locate and overcome.

3. All of the points gauged at any one operation must be within the control of that operation. Can you imagine anything more discouraging to a workman than to adjust his machine painstakingly, complete a tray of work, and then find that a large percentage of the pieces must be scrapped? To have one piece perfect and the next way beyond the gauge limits, both off the same machine and at the same cutting?

In Fig. 3 is shown an example of this error. Here is a flat piece with a recess cut into the top. In making this cut the part would usually rest on its bottom surface yet the simplest and perhaps the most likely gauge would measure from the top surface. Any variation in the thickness of the piece would endanger its meeting this depth gauge, although the thickness is entirely beyond the control of the last operator. If the machine is adjusted to cut properly on a part that is near the minimum thickness and the next part is up to the maximum, the cut will be much deeper and possibly beyond the limit of the gauge.

One peculiar danger in this condition lies in the fact that with great care a moderate production may be maintained without serious loss. In the example shown in Fig. 3 the workman who establishes the thickness and the one who makes the recess cut may, by close cooperation, arrange their work so that the result will come within the limits of the gauge. When, however, production increases, and especially when a night shift is started, this close co-operation is lost. The width now varies the full limit of the gauge, and the operators cutting the recess begin to lose time and patience, while production becomes seriously impaired.

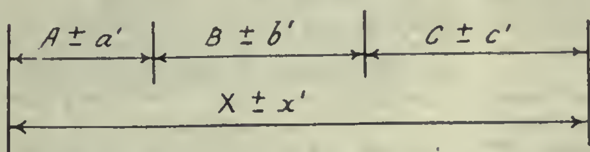
The worker is unjustly penalized and production is on an uncertain footing when one operation is dependent for its success on the accuracy of another operation not performed at the same time or under the same control.

4. The operator should be allowed the full limits of his gauges. In munitions work the limits on the finished parts are specified and are not within the control of the manufacturer. The operations and equipment must be laid out to meet these established conditions. Unless the manufacturer appreciates that every cut will vary independently of every other cut, and allows for this variation, he may be compelled to resort to the subterfuge of preferred tolerances. In other words, give an operator a gauge with .005 inch tolerance and tell him to work to the high side. This is an absurdity, nullifying at once the object and purpose of limit gauges. Provided the limits set by the Government are within reason, it is nearly always possible through careful study to give every operation definite workable tolerances.

In a way the computing of tolerances is a special branch of munitions, which, for a lack of a better name, might be termed "the study of variables within limits." It is controlled by a few simple rules that are almost self-evident, though apparently often disregarded. Some of these rules may be given as follows:

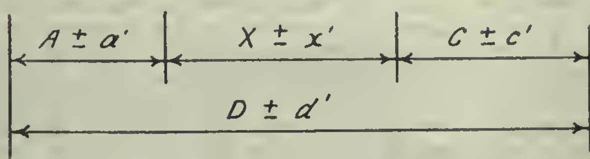
Rules for Tolerances

Rule 1. Any dimension comprising two or more dimensions, each of which may vary within certain definite limits, will be subject to a possible variation equal to the sum of the variations of all the component dimensions.



Maximum overall length =
$X + x' = A + a' + B + b' + C + c'$
Minimum overall length =
$X - x' = A - a' + B - b' + C - c'$
Possible variation or tolerance =
$2x' = 2a' + 2b' + 2c'$
Mean overall length $= X = A + B + C$
½ maximum + mimimum

Rule 2. When an overall dimension and all but one of the component dimensions are assigned definite limits, the possible variation of the remaining component is equal to the sum of the tolerances of the other components plus the tolerance of the overall dimension.

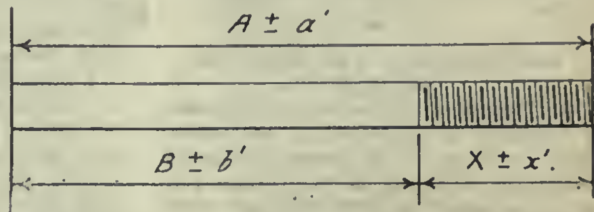


Maximum length of remaining component
$= X + x' = (D + d') - (A - a') - (C - c')$
Minimum length of remaining component
$= X - x' = (D - d') - (A + a') - (C + c')$
Removing parenthesis, first =
$X + x' = D + d' - A + a' - C - c'$
Removing parenthesis, second =
$X - x' = D - d' - A - a' - C - c'$
Possible variation or tolerance
$= 2x' = 2d' + 2a' + 2c'$
Mean length = ½ (maximum + minimum)
$= X = D - A - C$

A practical application of these two rules is that tolerances should never be given to all the dimensions forming a closed circle unless the tolerance on some one dimension is equal to the sum of the tolerances on all the other dimensions.

Another application is that when a dimension is obtained by several independent cuts, the limits given to these cuts must be such that the sum of their tolerances is equal to or less than the allowable tolerance on the resultant dimension.

Rule 3. The amount of stock left by a roughing cut for removal by a finishing cut is never a definite amount, but is variable with a possible range equal to the sum of the tolerance of the rough and the finish cuts.



Maximum amount left for finish cut
$= X + x' = (A + a') - (B - b')$
Minimum amount left for finish cut
$= X - x' = (A - a') - (B + b')$
Removing parenthesis, first
$= X + x' = A + a' - B + b'$
Removing parenthesis, second
$= X - x' = A - a' - B - b'$
Difference between maximum and minimum $= 2x' = 2a' + 2b'$
Mean depth of finish cut, ½ (maximum + minimum) $= X = A - B$

It is so usual to say, leave on .015 inch for a finish cut, that many engineers overlook the fact that the amount removed by this finish cut will more likely vary from .005 to .025 inch. This is an especially serious error when some other point is related to the rough surface, and then, when the finish cut is made, is assumed to bear the same relation to the finished surface.

Possible modifications of these rules are legion, yet practically all gauging problems can be solved by the application of these three. These in turn are all based on one great principle, namely, "Whenever a dimension is determined by two or more elements it is subject to a variation equal to the sum of the variations of all the elements concerned."

The importance of gauging has long been recognized in this country. With the war has come the need of not only making duplicate parts, but of making them in accordance with prescribed limits and specifications. The experiences of the last few years have brought home to most manufacturers of machine shop products a realization of the difficulties attendant upon analyzing these requirements; establishing the locating points and sequence of operations, and designing gauges to control in the actual work, the methods determined in the drafting and engineering departments.

Only by completely controlling each operation through the correct use of proper gauges can manufacturing difficulties be localized and the full talent of the organization employed to overcome them and facilitate production to the fullest extent.

KNOCKING IN GAS ENGINES

By M. M.

A knock in a gas engine is frequently a warning of approaching breakdown. For this reason, it is generally inadvisable to allow an engine to continue running a moment longer than it absolutely necessary when a knock is heard. It would be interesting to know how many disastrous breakdowns, entailing personal injuries and stoppages of work, might have been prevented, had the engineer-in-charge not failed to heed the warning given by a knock in some part of the engine.

In probably the majority of cases, knocking is the result of lost motion in some part or other of the engine. For instance, the connecting rod brasses may have become worn, or the fly-wheel keys may have worked loose, and so on As a general rule, the first thing the average engineer does when he discovers any knocking, is to close up the big or the small ends of the connecting rods, or both ends if necessary, and in many cases this will cure the trouble.

It will occasionally happen with large engines, however, that, after fitting new connecting-rod brasses, a new and heavy knock will develop in the engine cylinder. This may usually be accounted for in the following way: The continual motion of the piston to and fro in the cylinder has worn away some of the metal of the liner, leaving a ridge at the part where the first piston ring moves up to each stroke. Since the new brasses are thicker than the old ones, the effect is to cause the piston to move a little further up into the cylinder each stroke, with the result that the first ring strikes against the ridge each stroke, causing a heavy knock. Of course, if the engineer in charge has taken the precaution to fit liners behind the brasses, as wear has taken place, so as to maintain the correct centres, the trouble in question is not liable to arise.

To prevent this new knock, it will be necessary to remove the ridge referred to by chipping and filing. If it be impracticable to do this early, the first ring may be removed from the piston until such time as the true remedy can be applied.

Sometimes the piston rings themselves will cause knocking or rattling through their being loose, and it is not always an easy matter to trace the knocking caused in this way. When, therefore, a knock cannot be at once located, it is advisable to test if the piston rings are a good fit in their grooves.

Looseness of the fly-wheel keys is a somewhat common cause of knocking in gas engines. The conditions of working in a gas engine are of course severe, much more so than is the case with a steam engine, and with the increased pressures and speeds now in vogue, it is no easy matter to get the keys to remain tight for long periods of running. The slightest amount of slackness is obviously serious, as in addition to giving rise to more or less severe knocking, it involves risk of damage to the keys, and fracture of the wheel boss, and possibly the crank shaft. Loose keys are always liable to be met with if the wheel boss has been bored slightly too large or at all out of true.

It is not sufficient that the fly-wheel keys be quite tight, but they must be a perfect fit. In numerous instances, the keys have been found as tight as possible, but the fly-wheel was, nevertheless, slightly loose, and a heavy knock occurred in consequence. An interesting example presented itself, when a large gas engine was reported to be knocking, and the owners, who were unable to locate the knock, arranged for a firm specializing in engineering repairs, to look into the matter. The firm's men commenced their investigations by first removing the connecting-rod and piston, with the object of closing the brasses, but this was found to have been done already by the owners. The piston-rings were next examined for slackness or breakage, but these were found to be in good condition and to fit perfectly. The fly-wheel key was then examined, but proved to be quite tight. As the cause of the knock could not be located, those concerned decided to give the engine a thorough overhaul, yet after the work of overhauling had been completed, the engine, on being started up again, knocked as badly as ever. The cause of the trouble was, however, discovered shortly afterwards by chance. The engine had been stopped again, and the man in charge of the job happened to place his foot on one of the arms of the fly-wheel by way of a rest, and in order to think the matter over. Whilst in this attitude the man felt a distinct knock on the sole of his boot. This gave the clue to the solution of the trouble; obviously there must be some slackness or lost motion in the fly-wheel. Although the key had previously been found quite tight, a close examination of the key and its keyway were now made, and the examination served to show, not only was the key badly proportioned and badly shaped, but the keyway had been badly cut, being narrower in the middle than at the ends. In short, only a short length of the key was really effective in securing the wheel to the shaft, and this was the cause of the whole trouble.

It has already been pointed out that the continual motion of the piston to and fro in the cylinder gradually wears away some of the metal of the cylinder liner, leaving a ridge at the end of the travel of the first piston ring. In extreme cases the wear is so pronounced, that the piston becomes quite slack in the liner, and this will sometimes prove to be the cause of the knock. Thus, when the explosive mixture is fired, the force of the explosion causes the piston to shake against the internal surface of the liner, and a knock is thus liable to be heard each explosion stroke. A knock of this character can scarcely be regarded as a serious one, since no undue stresses are likely to set up on any of the parts. What is perhaps of more importance than the knock is the loss which will probably occur by leakage of the explosive mixture past the piston. The remedy for the trouble is, of course, to re-bore the cylinder liner and fit a new piston, or else to fit both a new liner and a new piston.

One cause of knocking in gas engines, but one which is usually easy to discover, is undue clearance between the spindles of the different valves, and the levers which oprate the valves. When the valves are properly adjusted for lift, they are first opened very gradually by the cams which work the levers, and then more rapidly. When, however, there is a considerable amount of clearance between the valve spindles and the levers, the latter, instead of coming into contact at a moment when they are moving very slowly, only do so when the rate of motion has become comparatively great. The result is that the levers, instead of coming into gradual contact with the spindles, bang against them, thus tending to cause a knock. If now the valves lift easily, the force of the blow is relieved, and the knock will be of little importance, but if, on the other hand, much force is required to lift the valves, the knock is liable to become somewhat severe. In the case of the gas and air valves, comparatively little force is required to open the valves, because each valve opens at the commencement of the suction stroke, when the piston is really reducing the pressure against which the valves have to lift, and so assisting in opening them.

Now the case is quite different with the exhaust valve. This valve has to open at the end of the explosion stroke, when the pressure in the cylinder is considerable. Since, in addition to this pressure, the pressure of the spring which keeps the valve down on its seat during the admission, compression and explosion strokes have also to be overcome, not to speak of the weight of the valve itself, it is not difficult to understand that the force required to open the valve is considerable. Hence, when there is much clearance between the exhaust valve spindle and lever, the knock resulting may prove to be somewhat serious. The force of the blow is, of course, transmitted to the teeth of the skew wheels, which drive the cam shaft and if these teeth are much worn, as they frequently are in engines which have seen much service, risk of breakage of the teeth is incurred. Knocking of a somewhat similar nature to the above will sometimes occur as the result of undue wear of the rollers, against which the cams work, the latter banging against the rollers once each cycle. Indeed, in old engines, where all the cams have become badly worn, the working of theh engine has, in consequence, sounded like the rattling of a basket of pots.

Another somewhat common cause of knocking in gas engines, is early firing of the explosive mixture. Thus, if the charge is fired much before the piston reaches the end of the compression stroke, the general effect is to tend to check suddenly the motion of the piston, so that if there is the slightest lost motion in the moving parts, a more or less severe knock is liable to occur each cycle.

Too early firing may of course be caused through improper adjustment of the ignition arrangements, but it will sometimes occur when the adjustment is quite in order. The trouble will then generally be due to the deposit of carbon on the valves, the cylinder end, and on theh piston.

When the trouble referred to is experienced, it is therefore well to look for evidences of carbon deposit, and should any be discovered, it should be removed at theh earliest opportunity. Satisfactory removal can, as a rule, only be effected after the piston has been withdrawn. It is far from wise merely to loosen the deposit and trust to this being blown out through the exhaust valve. Unless the deposit is positively removed by hand after the piston has been withdrawn, there is every probability that the engine will soon suffer severely from scored piston rings and cylinder walls.

TURNING MARINE THRUST SHAFT

One of the most important parts of a marine engine is the thrust shaft, which transmits the whole thrust of the propeller to the hull, through the medium of the thrust block. It has also to transmit the power from the engine to the propeller, therefore being also subject to torsion. The collars on the thrust shaft have to be turned and faced accurately to ensure an even bearing on all the surface of the thrust shoes. The illustration shows a 13¼ inch diameter, thrust shaft for a large steamer, on the lathe. The engines for which this shaft was built are triple expansion, 25 inch by 42 inch by 67 inch by 42 inch stroke. The flanges of the thrust shaft are 25 inches diameter, collars 22 inches diameter, and the total weight 7,000 lbs. The tail end shaft and all the intermediate shaft lengths were turned up on this lathe, which is the 42 inch triple geared engine lathe of the Canada Machinery Corporation. This lathe has been designed expressly for machining heavy pieces such as described above, and is made especially strong to carry the great weights involved. The bed is made very deep and braced with cross ribs of box design. The headstock is made proportionally strong with the base, and is provided with a four step cone, and back geared drive, in addition to a triple geared drive direct to face plate. The cone has extra wide faces to enable a wide belt to be used, this giving greater power than usually obtainable in this class of lathe. The changes of feed are obtainable through the feed box on the bed below the headstock, and by changing the gears on the head and quadrant plate, any desired feed is obtained. The lathe in the illustration is fitted for motor drive.

Washington.—Ships carrying 200,000 tons of food for the populations of France, Belgium and Austria are now en route to Europe, proceeding under sealed orders to Gibraltar and Bristol Channel ports. They were sent on Mr. Hoover's orders.

New York.—The impending deal, by which 100 ships owned by the Mercantile Marine Company would pass to a British syndicate, has been suspended by request of the authorities at Washington. Directors of the company will meet again this week, when it is expected definite information from Washington will be forthcoming.

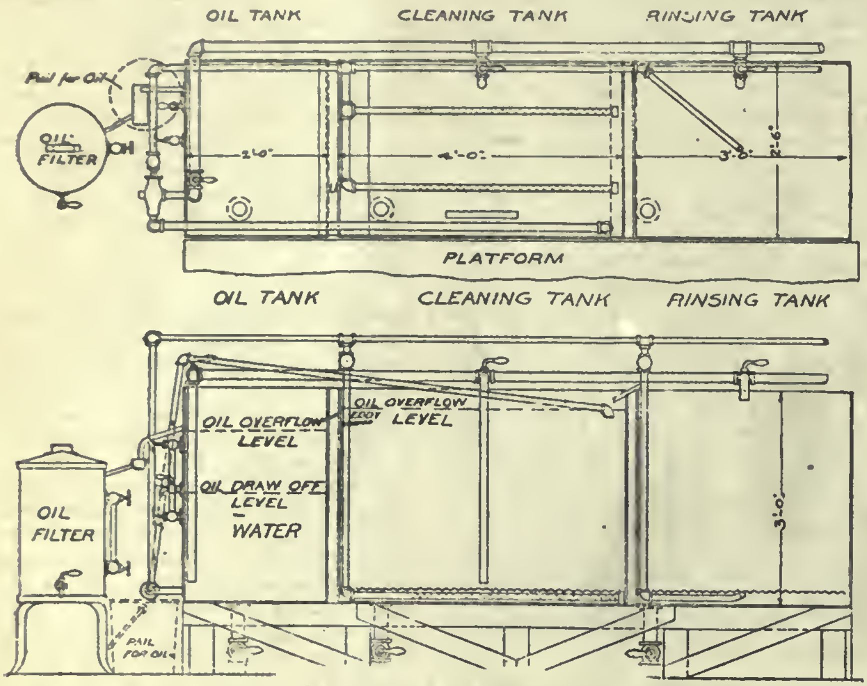
SALARIED MEN

The tendency of modern business is to favor payment by results, for there are few branches of work in which such payment, where it can be applied, does not yield increased output and earnings. Even before the war some industries could not prosper without it, and after the war, few will be able to survive that do not adopt it. Methods of payment by results are naturally easiest to devise for men engaged on direct production, whose individual work can be directly measured. They are less easy to arrange, though not impossible or unusual, for the much smaller class of men who have the entire control of some separate manufacture. But between these two extremes there are large numbers of men whose work, though it is indispensable to production, cannot be identified or measured separately. They included some of the most valuable workers, whose skill may often require an education as well as ability much beyond that of those who are paid by results. For the efficiency of an industry to be maintained, or advanced, the right men must be attracted into this class of work, and, in order that they may be, their reward must be made attractive. There is too much reason to believe that salaried men as a class are paid less than they would get if the actual value of their work could be measured, particularly those in posts that receive the medium or lower salaries. The draughtsman, the works engineer, the works chemist are usually keen on their work and do their best; but this is not sufficient if the best men are not attracted, nor can underpaid men of ability, however good their intentions, do as well when engaged on work that is not paying them fairly, as they could with the encouragement and stimulus of proper remuneration. The standards of salaries paid for this class of work will determine the class of lads who will look to it for their careers; and the engineering trades might well consider whether these standards are as attractive as would be reasonably prudent.—M. E.

TURNING THRUST SHAFT FOR MARINE ENGINE

THE RECLAIMING OF COTTON WASTE

NEW cotton waste costs from eleven to fourteen cents a pound. It can be recleaned by a simple process for less than a cent a pound.



LARGE TANK WASHING OUTFIT

For many years it was quite a common practice to use, for fuel waste and wiping, cloths which had been used about power plants and machine shops for wiping purposes. A cheap and simple method has been worked out whereby waste and rags can be recleaned at an average cost of three-quarters of a cent a pound. The process in use in a large number of plants for several years is very simple and on account of the low cost is finding increasing favor among not only manufacturers, but power plants, printing establishments, railroads, and all branches of industry where waste and cloths are used.

One of the main advantages of this process is that the waste or cloths are in better condition after washing than when new, as the washing does not injure the fiber, but makes the waste or cloth softer and consequently more absorbent. Waste or rags cleaned by this method can be recleaned from one hundred to one hundred and fifty times, or until the material is worn out.

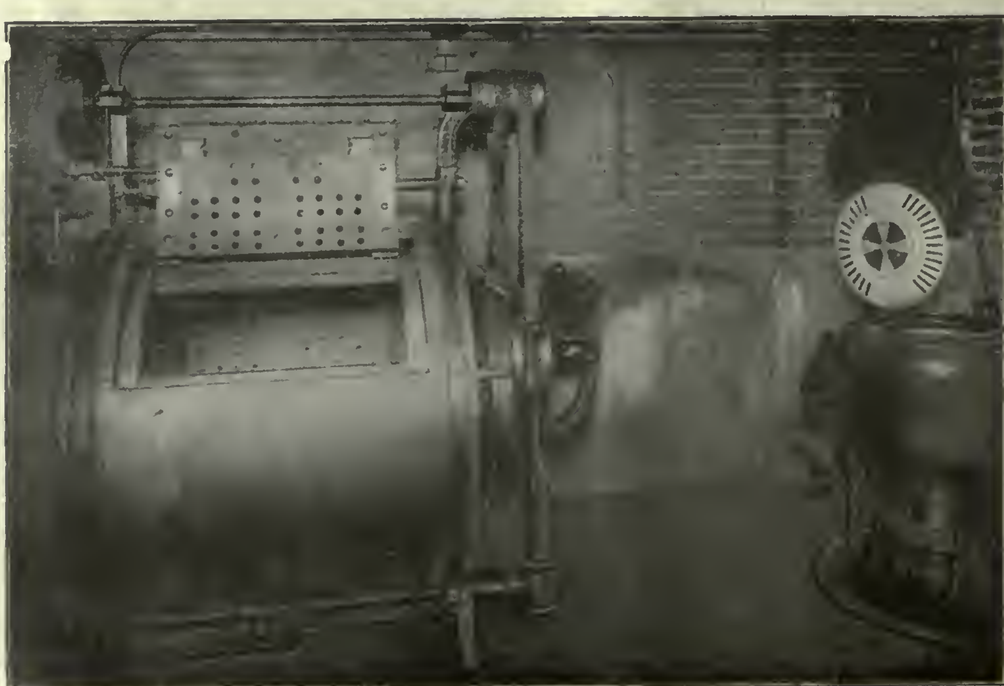
Oakite, the product which does this work so effectively, is a dry white powder—a combination of mineral salts which dissolves readily in water. It contains no acid, sal soda, potash, or lye, or other substances which are injurious to the most delicate fabrics or the human skin. Oakite cleans on an entirely new principle. It emulsifies oil and greases—breaks them into finely divided particles, thus destroying their adhesive nature. This is a purely physical action. The action of old time alkali cleaners is chemical. They saponify oils and greases, combine with them and are thus rapidly used up. Only a small amount of oakite is necessary to emulsify a large amount of oil or grease.

The process is as practical for a man who washes a few pounds of cloths or waste a month, as for the plant which washes a ton a day. For a small plant the only equipment necessary is a barrel or tank with a steam pipe or coil. About twenty-five gallons of warm water is run into the tank and two pounds of oakite is dissolved in the water. About forty pounds of material to be cleaned is placed in the tank and the water boiled for fifteen minutes. This liberates the oil, which rises to the surface of the water and may be reclaimed by filling the tank with water until the oil runs out of the overflow. When no more oil escapes from the waste, the washed material is rinsed in a separate tank, and after drying is fit for use again. The character of the oil is not affected by oakite and it can be reclaimed and used again.

For concerns washing two or three hundred pounds of waste or cloth at one time, or twelve pounds a day with one man operating, the equipment consists of a large tank built with three compartments—one for washing, one for rinsing, and one for the overflow of oil and water. Have the washing compartment in the middle. This should be equipped with water and live steam connections. A centrifugal dryer is convenient and effective. An oil filter may be used with good results for reclaiming oil. A diagram herewith shows the details of a serviceable equipment for washing waste or cloths and filtering the oil.

A laundry wheel or similar equipment can be used.

A booklet containing diagrams of tanks and outlines of formulas and methods suited to all conditions for cleaning waste and wiping cloths will be furnished on request by the Oakley Chemical Company, 22 Thames street,



WASHING WIPING CLOTHS WITH OAKITE—LAUNDRY WHEEL METHOD—36" x 39" STANDARD LAUNDRY WHEEL ON LEFT; 22" CENTRIFUGAL WRINGER ON RIGHT.

WELDING AND CUTTING

The Electric Arc Used in Steamship Overhauling

Westinghouse Arc Welder Does Good Work in This Line—Repairing a Furnace While Under Steam—Variety of Work Carried On

THE all-round usefulness and adaptability of the electric arc method of welding is well exemplified by the work carried out at the repair shops of the Canada Steamship Lines, at the foot of Yonge Street, Toronto. The machine, which is a Westinghouse arc welder, using direct current of 150 amperes at 75 volts, was installed in 1915, and was one of the first machines to be imported into Canada. The machine shop was started at the same time and has grown into a well fitted up repair shop, where practically all the repairs necessary for the company's steamers can be carried out with ease. The shop and welding outfit are under the supervision of Mr. Noonan, the superintendent engineer of the company, and some very interesting repairs have been performed under his direction. The welding metal used is a soft Swedish iron wire known as Premier welding wire, and during the years of the war, this, like most other steel material, has been hard to get, but since the armistice has been signed Mr. Noonan has been notified by the Steel Company of Canada, who supply this wire, that they can now fill his orders. Last winter no fewer than twenty steamers were laid up at Toronto, and the repairs made at the company's shop, so that there is no lack of work for the machine shop or the welding apparatus; in fact, a welder and helper are kept steadily at work all the year round, and in the summer season, when the boats are all working under conditions of rush, the welding outfit makes possible quick repairs, and eliminates delays. As an instance of this, an especially interesting case might be mentioned. One of the steamers came into port with a furnace leaking, and it was feared that she would be subject to considerable delay. In the ordinary course of events she would have been delayed quite a bit. The cause of the leak was a crack in the furnace tube, and the usual way of repairing this would be to drop the pressure off the boiler and repair the crack by either plug stitching or a patch, according to the condition of the furnace. However, it was decided to repair the furnace by the electric welder, and furthermore, to do it without waiting to lower the steam pressure. This was a bold policy, but such was the confidence felt in the process that no hesitation was expressed by anyone connected with the job. The vessel was brought round to wharf where the machine is installed, and the cable led aboard. The boiler was carrying 125 pounds of steam per square inch, and the job was done with this pressure on. The first difficulty was to stop the water leaking through the crack, and by deft manipulation of the electrode, a thin skin was worked over till the leak was stopped and then the weld was built up in the usual manner. That job held tight all the rest of the season, and was found to be perfectly good when the vessel was laid up at the end of the summer.

Another case was that of a boiler which had undergone extensive repairs, having new combustion chamber back sheets fitted and necessarily new combustion chamber stay bolts. The repairs being completed, the boiler was put under hydraulic test, and at 125 lbs. pressure per square inch, a leak developed in the back head near the ring seam. It was decided to call in the services of the welding machine once more, and the repair was made in practically the same manner as the repair on the furnace. The first thing to do was to stop the water leaking through the crack, and once this was accomplished, the weld was built up to the required strength. This job was also perfectly successful, no further trouble being experienced. For this kind of work there is no doubt the arc welding is superior to the oxyacetylene flame in the opinion of the men who have these jobs to do, and there is no doubt that the feature the electric arc pos-

WELDING REPAIR TO MARINE BOILER

sesses of applying the heat right at the job itself, and localizing it, has a great advantage over the much larger surface affected by the oxy-acetylene flame. The usual method of repairing a crack or leak is to V the bad spot out so that it can be rebuilt with new metal. If the part is very bad or covers a large area, the piece can be cut out completely and a new piece fitted in. New nuts have been formed on the end of combustion chamber stays by the building-up process, and stay tubes stiffened at the end where corrosion has taken place. Paddle wheel arms are welded in place, badly scored piston rods have been filled in and then turned up as good as new, and many other varieties of repairs are performed daily.

The subjects of our illustrations are repairs on circumferential seams of boilers in one of the company's steamers. The first illustration shows the welder closing up a leaky seam at the forward end of the boiler, close to the floor plates a job which is one of the most awkward to be done by hand caulking. The other illustration shows a completed repair on the circumferential seam at the after end of the boiler, at a part where the marine boiler is peculiarly liable to corrosion. This is on account of wet ashes lying against the shell during the periods of cleaning fires, and at other times, and also to the effect of leaking gaskets on the manhole door, the water running down and along the seam. This seam also is liable to leaks due to the unequal expansion of the boiler shell when raising steam, and even when working. It is not unusual in a boiler which has not been properly circulated, to find this part of the shell and head comparatively cool long after the pressure has been raised to the working point.

SWITCHBOARD

We are indebted to the courtesy of Mr. Noonan for the opportunity to obtain these illustrations, and the information furnished by him.

A NEW PRINCIPLE IN WELDING AND CUTTING APPARATUS

The Bastian Blessing Co. have recently issued a new pamphlet descriptive of some of the interesting features and design of their cutting and welding apparatus. Owing to a new principle introduced in the construction of their torches they have eliminated all flashing back and have succeeded in making their torches operate on very low combined pressures. This results in increased production, as it is well known that the flashback is one of the greatest time-wasters in the oxy-acetylene process.

In the operation of the Rego torch equal volumes of both gases are used, this condition being necessary to produce a neutral flame. With the acetylene under a slightly higher pressure that no more oxygen can come through the flame than is necessary to burn the acetylene, thus the flame at no time can become oxidizing in character, and all burning of the weld is completely eliminated.

NEW ANTHRACITE PRICE

Inquiry at the office of the Fuel Controller as to new prices on anthracite, coal elicited the following information: The price charged for anthracite coal in Canada is based upon the prices in the United States, and these are fixed by the U.S. Fuel Administration. In an official despatch from Washington an increase of $1.05 per ton is authorized on domestic sizes, the revision being made to meet increased labor costs. Emphasis is, however, placed in the fact that the new price schedule is effective only on coal mined on or after November 1. Dealers in the United States have been advised by the Fuel Administration that the increased price applies only on coal shipped and delivered after November 1 upon the production of which there has been paid the increase in the scale of wages to the miners. Dealers in Canada should govern themselves accordingly. It is suggested that consumers who are in doubt as to proper billing for coal should refer the matter to the local fuel commissioner.

ACID FOR FERTILIZERS

U. S. War Chemical Plants Will be Used in Producing Crop Coaxers

Before the Toronto section of the Society of Chemical Industry, Prof. J. Watson Bain delivered a lecture on "The Canadian War Mission at Washington and Canadian Industry." Prof. Bain gave up his work at the Toronto University to become technical adviser to the mission.

He dealt with what should be done with the huge plants built for preparing chemicals used in explosives, and stated that a great part of it would ce used in the preparation of acid phosphates to be used as fertilizers, which were needed in great quantities in Canada. He dealt with the fixation of atmospheric nitrogen and stated that cyanamide was already being produced in Canada, but with the plentiful supply of cheap power it would be possible, by several methods, to successfully extract nitrogen from the air. Another application of the power could be made in the manufacture of ferro-alloys used in the manufacture of steels.

He described the enormous scale on which the Americans had been manufacturing poisonous gases, and stated that, had the war continued, the Huns would have had their own medicine back in unprecedented quantities.

A new and very valuable copper ore has been discovered in the district of Varmland, Sweden. It is said to be an oxidized copper mineral consisting of about 90 per cent. pure copper and a small quantity of gold. The mining will probably soon be commenced.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

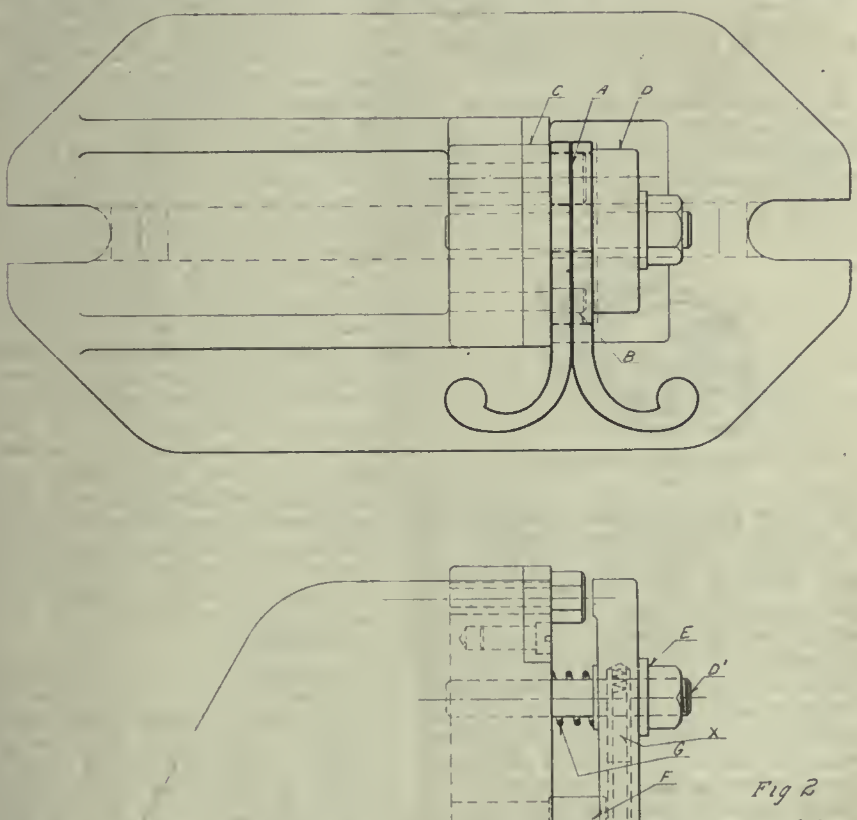
A FORM MILLING JOB ON TWO PARTS

By H. M.

FORM milling, such as is very often resorted to on parts of irregular form, is seldom done to better advantage than is illustrated in Fig. 2 of this article. The work to be operated upon upon is shown in Fig. 1, which is flat on both sides, has curved end and is shaped similar on both edges. This part has a round hole in it and a rectangular slot.

In milling the edges on this part advantage is token of the round hole and the rectangular slot for locating. By referring to Fig. 2 it will be seen that a pin A fits in the hole of the two parts and that the tails on the two parts stand out in opposite directions as is obvious from the illustration. In the rectangular slot of both pieces the pin B is placed. These locate the work the correct height from the table of the machine and radially about the round hole as a center. The two parts are next clamped against the steel plate C by the clamp D, a nut and washer E on the stud D being used for this purpose. Under the tail of this clamp a pin F is used, while the spring G pushes the clamp away from the work when it is released to remove the same. In order to remove the work this clamp is pushed down and it is held down while another part is being put in place. After the work is put in place the two spring pins H push the clamp up until the slot at X comes against the screw, following which the work is clamped as described. The cast iron base, with the tongues to fit the groove in the milling machine table, completes this fixture.

The most interesting part of this fixture apart from the clamping arrangement is that the milling machine cutter forms one-half of the work, including the radius Z up to J on the right hand edge of one part and the left hand edge of the other, and by reversing the position of the two parts the opposite edges are formed, thus one cut on two parts finishes one complete at each setting. Two fixtures were used for machining



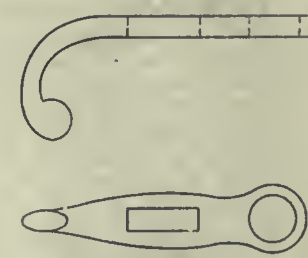


Fig 1.

FIG. 2—PLAN AND ELEVATION OF JIG.

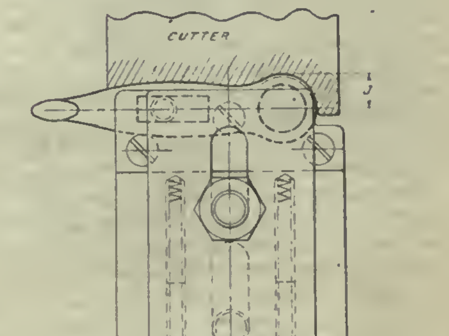


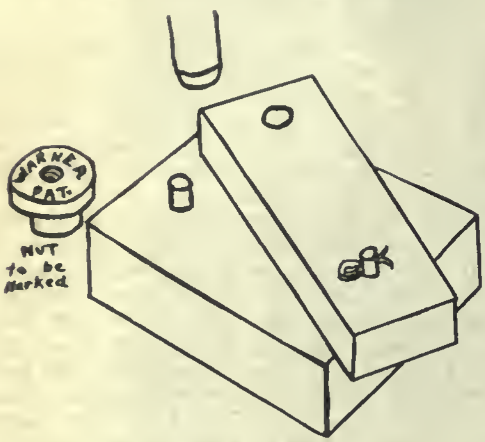
FIG. 3 END ELEVATION

these parts, one being loaded while the cutter was milling the parts in the other fixture.

MARKING BRASS NUTS

By D. A. H.

There were about ten thousand round brass nuts to be marked with the company name. See the figure. A hole was drilled in a piece of steel and a boy set to work to mark them with a hand stamp and hammer. It was an unimportant sort of a job and we were glad to give the boy something that would keep him going for a couple of days. But one of the men willed otherwise.



MARKING BRASS NUTS

He asked permission to spend two hours in rigging up the job to "do it five times as fas on the No. 18 Bliss"—and permission was granted.

In the figure the base is a piece of cast iron picked up and the pivoted piece is a length of cold drawn steel. This latter turns about the pin held in by cotters above and below and rests against a stop pin when the hole (with the nut dropped in it) is under the center of the press. By means of a bushing, the hand stamp was held in the ram of the machine; this dispensed with the use of a hammer entirely and left the boy with nothing to handle but the nuts.

Along with ease of loading, a safety feature was obtained that is worthy of notice. The piece of steel is swung around toward the operator for loading and unloading; after it is filled it is swung back against the stop pin by the simple operation of moving the short end of the piece. This keeps the hands at all times several inches away from the danger zone and the extra movement takes no more time than would be required in placing and replacing the nuts in the more awkward and farther-away hole if it had been made stationary in line with the blow.

OLD-FASHIONED PAINT REMOVERS

The following recipes for alkaline paint removers are of the old-fashioned type; the modern quick process paint and varnish removers, while doing this work very well, and indispensable for refinishing wood in the natural, are entirely too high a price for use in removing paint on surfaces to be painted over. The recipes are as follows:

Dissolve 40 lb. caustic soda, 98 per cent., in 5 gallons of water. Take 8 lb. fine whiting and 4 lb. corn starch, and mix with 1 gal. of the caustic solution to form a paste; apply with an old brush, and leave the paint on for about twenty to thirty minutes. When the paint has softened, wash off with water, using a scraper where required. Will also remove varnish.

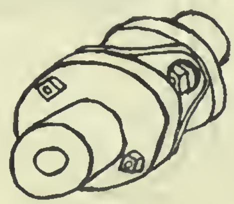
Another very good formula is: Mix 7 lb. of caustic soda, 98 per cent., with 15 lb. warm water; mix 1 lb. corn starch and 11 lb. china clay with 1½ gallons of water, adding to it the caustic soda solution, forming a paste that must be beaten until free of lumps. Apply freely to the surface with an old brush and permit it to remain until the paint or varnish has lifted, then scrape and wash off with warm water. Wall paper can also be removed in this manner, when the remover is further diluted with water. For cleaning painted surfaces, use a weak solution of the remover.

Operators, whose hands are easily affected by strong lye or soda solutions, should wear rubber gloves while working with the remover. In order to neutralize the alkaline nature of the remover a small portion of vinegar can be added to the water used for cleaning off, say 1 gill to each gallon of water.—M. M.

LEATHER FLEXIBLE COUPLINGS

By D. A. MIDDLETON

The use of leather couplings has increased surprisingly in the last few years. The self aligning feature, their moderate cost, the ease of installation—all have contributed to their popularity.



FLEXIBLE COUPLING

Up at the gas works they had a couple of turbine-driven blowers that had always given trouble with the bearings. They wouldn't have anyone but us do their repair work and we diagnosed the trouble as misalignment between the two units of a set; we wanted to put in leather couplings, but the management was staid and refused, and after we refused to do any more work on the machines as they were, they let them run, leaking and heating and pounding.

One Sunday morning Smith, the superintendent, called up at six o'clock, said something had to be done, they couldn't get the gauge up to sixteen the night before and it ought to have stood twenty. All this I had anticipated and had had a coupling made up and waiting. The drawing shows this and the simplicity of a leather coupling for driving shafts. Well, Smith consented to having the rigid coupling taken out if we would run new bearings and get the unit in shape for night. So, accordingly, this was done that Sunday (as it had been done before with little results) and the leather coupling put in. In the two years since there has been no heating with those bearings and the gauge stands up to twenty all the time. Final proof is found in the order Smith just gave us to so equip the other machine.

THE EFFICIENCY MERCHANT

By A. L. Haas

The purveying of efficiency in the shape of so much confidential talk, and the installation of some card index system at inclusive rates for such service, is a matter quite easy to ridicule. Indeed, efficiency cannot be so retailed.

Like success, efficiency cannot be handed down ready made, similarly to reach-me-downs or packeted sundries, and all the advice in the world is fruitless failing the right spirit to effort. Like political catch cries, or newspaper shibboleths, certain ready-made phrases easily coined have an hypnotic influence and are currently popular.

Efficiency in any trade or business cannot be captured by the aid of a casual stranger, unused in the particular line.

Even scientific management is the result of much diligent application of experience, knowledge and commonsense to particular problems of industry. Although an organizing genius (few exist) can show results after patient disentanglement of current problems, it is impossible to transfer system unchanged from one location to another.

Efficiency research means the application of a dispassionate and unprejudiced intelligence to simple problems in sequence, using patience, tact, and discrimination (this last is of importance) for the purpose. The present aim of efficiency propaganda is to raise the commonplace and average to somewhere near the exceptional, by pre-vision and stimulation. Catch cries are useless without definite planning and good staff work. Some of the literature of the movement leads the reader to suppose that scientific management has discovered afresh the cardinal virtues, actually its process is as old as Eve, it asks why? and when the answer is insufficient or unconvincing it investigates and provides a new solution.

The alleged specialist who hawks round empirical specifics is most often unable to land results unless conditions are identical; in actuality they never are similar. Absurdities abound in the spellbinding of the orator who, utilizing industrial phrases, weds the methods of the revival preacher and the electoral platform to achieve an evanescent effect.

Efficiency cannot be achieved save by the ancient method of diligent application, hard work, and definite and specific hard thinking. The only merit in the outsider is his unbiased viewpoint; it is some asset towards fresh conception; ignorance in this wise may be useful, since tradition does not bind his feet nor enchain his understanding, otherwise the peculiar virtue of the specialist efficiency merchant seems a type of mental alertness, some smooth phrases, and a bewildered proprietor; this occurs often enough to warrant notice. Efficiency is relative; its practitioners were not unknown before the advent of the stunt performer.

Predisposition is the greatest single item affecting the human change, persuaded is half way to alteration, and the hope of present propaganda and publicity is that curiosity re-aroused will serve to invoke the general spirit which strives, not so much toward repentance as to fresh conception.

It is the mind reluctant to accept existing conclusions as ultimate, and willing to experiment undaunted by partial failure, who is likely to reach tangible results. The efficiency merchant has performed one useful purpose, he has aroused curiosity, stimulated desire, but has not provided and cannot provide a panacea; the solution in each case has to be wrought out by toil, the application of tough mentality, and can be reached by the determined without vicarious aid.

Men past the first flush of youth shrink often from the unusual because it is strange. Efficiency is to be won, not bought, and its price is an unremitting vigilance and flexibility of mind; moreover, there are not enough efficiency merchants to go round; one should be permanently stationed in each works, and it is best that he be the responsible man—whether director, proprietor, or manager. Without bluff or brag there are many such, and it is noticeable that the external investigator avoids some industries altogether; he would be out of breath long before he began to catch up with those vitally interested, who are responsible.

RETURNED SOLDIERS SHOULD BE PROTECTED FROM FRAUD GAMES

Editor CANADIAN MACHINERY:—

The name "Returned Soldier" is in danger of becoming very much wronged. We have all the sympathy possible for the returned men, and are willing to do all we can to help them regain a footing in civil life.

But there are cases where men have played on this fact, perhaps to their own advantage, but to the disadvantage of the returned soldiers as a whole. And, furthermore, there are cases where men have actually claimed to be returned men, and have played on people's sympathies and purses, when they have never been out of Canada, and have never even tried to enlist.

Such a case as this came to light a few days ago when a man who was canvassing subscriptions for one of the Toronto daily papers claimed to be a returned soldier, and in proof showed a hand with the fingers badly mutilated. However, no returned button was in sight. And when questioned on this point he said that this returned soldier business was being done to death and the best thing a man could do with his button was to leave it in the pincushion on his dresser.

On making inquiry at the newspaper office where he was employed, it was found out that the man had never had a uniform on, and had had his hand mutilated in some factory.

We are all ready and willing to help the returned man when he needs our assistance, or even to help this man with his maimed hand. But when a man, be he returned soldier or civilian, claims he is making "about five dollars a day," it does not seem fair that either one should play on his infirmities to elicit the sympathy of the public.

We want to help the soldier. But we think it only fair that he should help himself. He shouldn't whine about being a returned man. He should be glad of it. Glad he was not buried on the battlefield. Glad to be alive to return to Canada, to live in the peace he has helped create.

All honor to the returned man. He has done his bit. He has heard and heeded the call of King and country. He has helped to make the world safe for democracy. But don't let it be possible for a few returned men, and a few despicable cowards who claim to be returned men, to spoil that glorious name "A Veteran of the Great War."—READER.

FRICTION FABRICS

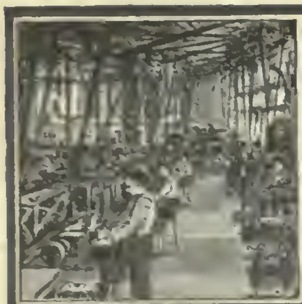
By H. A. L.

The material wherewith to line clutch and brake surfaces has always been a problem. In railway work the cast iron shoes used wear out rapidly, and it is considered more economic to have the metallic wastage upon the easily-renewed and cheaply-produced brake shoe than on the expensive tire. At the same time the metallic wastage irrecoverable as scrap must be very large. In the motor car the cone clutch largely used has most often a leather lining, while the brakes are steel bands over drums, which serve to give the braking effect when controlled from the dashboard.

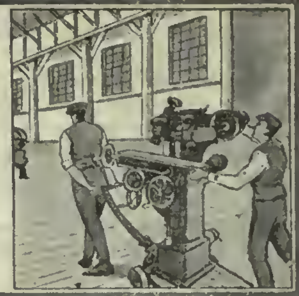
Recent solutions of the problem have led to the marketing of textile fabrics of special type for which large claims are made. One of these materials seems to have disappeared, but the other is rather prominent.

Both claimed an asbestos foundation, and are supplied in a form resembling belting or braid of very coarse texture. As in the case of engine packing, the experienced engineer is always somewhat curious and sceptical, and while no doubt is cast upon the efficacy of the materials the result of a close examination is interesting. At first sight the resemblance to what is known as wire woven, high-pressure packing is considerable, the chief feature of the construction seems to be the combination of a single brass wire of fine gauge as the core of a rather coarse textile thread. High pressure packing is similar in construction, the asbestos fibre being rolled or carded on to a wire core. This reinforced or composite thread is then woven into the familiar forms.

In the case of the material discussed, the claim as to the inclusion of asbestos seems hardly warranted, for the thread seems to consist of a large proportion of fibre other than asbestos. It was claimed at one time that old sail canvas made the best canvas engine packing, universally known as Tuck's, the stretch having been taken out of the fabric by prior use. At the same time such material is initially cheaper, and the economic factor would probably be a greater incentive than the reason alleged. However this may be, in the friction lining similar material seems indicated, the fibre looks more like old rope, either hemp or manila. It has occurred to the writer that the inclusion of asbestos is to minimize overheating in the absorption of power by friction. The rope used in the Prony brake does occasionally smoke, but not usually, unless its proportions are inefficient and it is grease saturated, when its liability to overheat is similar to that of oily waste. The presentation of a wire mesh surface by wear in conjunction with a textile material of frictional qualities finds a precedent in the non-slip stair tread, where lead and steel or cast iron form a composite surface, the harder material, whether as straight lines or woven wire diminishing wear while allowing the softer metal to exercise its non-slipping qualities. Lead in this particular is the safest material known, even when greasy, or otherwise rendered in a condition where other metals would provoke accident. The tendency to slip on greasy M. S. chequer plates is very pronounced. Asbestos being immune from any tendency to fire, and since it can be procured wire-woven it is a little surprising that the ordinary commercial material used everywhere for engine packing should be unknown as a brake lining. Perhaps it is the initial cost of such high grade packing, but the results of any tests would prove interesting. The material marketed under a trade name is certainly cheaper to produce so far as a detailed examination would show, but if engine packing of the type indicated serves the same purpose this should exert a salutary check upon any undue price. It certainly seems open to the engine packing maker to heavily adulterate his product with alien fibre of cheaper character and make this up in suitable dimensions. To add to its resistivity some drying oil or resinous substance may also help its friction qualities.



DEVELOPMENTS IN SHOP EQUIPMENT



Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

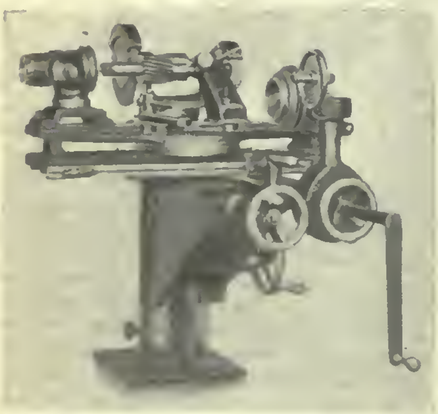
UNIVERSAL TOOL GRINDER

In developing their Sterling Universal tool grinder the McDonough Manufacturing Co., Eau Claire, Wis., have produced a machine which is substantially built and will grind any shape cutter in a satisfactory manner. They are particularly adapted to the grinding of cylindrical internal angular and face work such as counter-bores, face mills, internal gauges, end mills, gear cutters, reamers, jig bushes, flat surfaces and formed cutters.

All slides are machined and hand scraped to surfaces, plates and straight edges, giving true and flat surfaces with co-operating parts machined and hand scraped to fit perfectly.

Guards for the wheels protect the operator in the event of a wheel bursting. These guards need not be removed in any operation possible, as they do not interfere with the grinding capacity of the wheels. The value of such guards cannot be overestimated.

The base and column are cast in one piece, thus giving greater rigidity to the machine and eliminating any chance of vibration of the knee or table.



UNIVERSAL GRINDER SET UP FOR SHARPENING CUTTERS.

The base is of cabinet construction, heavily ribbed, and has ample space for storing attachments if desired.

The sleeve or outer column which fits over the main column, is of one piece construction with large V knee slides. The sleeve locks rigidly to the column at any desired point by means of hand screws and friction collars. The hand screws are set directly on the gib and instantly lock the sleeve to the column with a half turn.

The wheel spindle is of exceptionally large construction, hardened and ground and accurately fitted in S K F self-aligning double roll ball bearings equipped with dust covers. All adjustments necessary where brass or bronze bearings are used, are eliminated by the use of these bearings. The fact that ball bearings are used makes it possible to use a larger diameter spindle, adding to the stability of the grinder and its ability to take heavy feeds.

The head stock is full universal and is graduated in degrees for vertical or horizontal swivel, and revolves on a removable base clamped to the table T slot. The head-stock is fitted with a taper arbor with provision for driving work on live or dead centers. The tail-stock is spring controlled with current actuating lever lock.

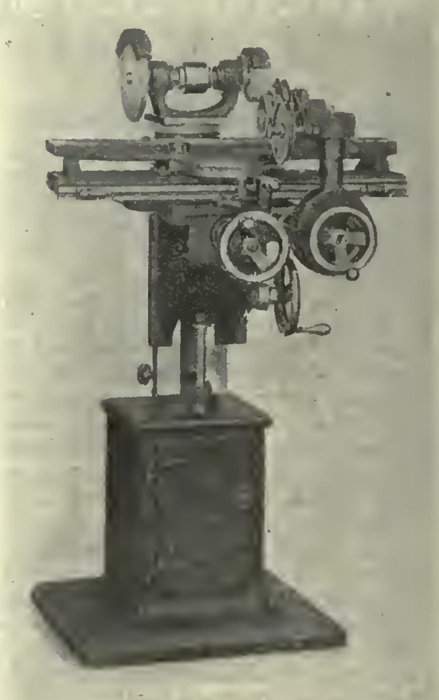
The internal grinding attachment is removably mounted on a flange formed with the spindle bracket and consists of a tool steel spindle fitted to run in two S K F ball bearings. The attachment is clamped on the machine and is driven by belt from an arbor pulley mounted on the wheel spindle.

The transverse movement of the table is actuated by means of a hand wheel located directly in front of the knee. The motion is transferred to the platen table by means of a screw, which functions in a bronze nut fastened to the bottom of the saddle. A micrometer gauge on the screw spindle makes adjustment of the table accurate to the thousandth of an inch.

The longitudinal movement is actuated by a hand wheel located to the right of the saddle through a rack and pinion which is in turn moved through a set of spiral gears. An attachable long crank is supplied for giving a more delicate hand movement for certain reamer work and similar operations.

The automatic power feed attachment makes easier and more rapid work possible. The power feed device is attached in place of the hand table feed, and comprises a reversing mechanism enclosed in an iron case, and a bevel gear transmission to a vertical which in turn carries a grooved cone pulley for driving the feed mechanism. A special feature of this feed is its adaptability for work in any position as the pulley can be lined up with the driving drum regardless of the table position.

The Coppus Engineering and Equipment Co. have issued a new catalogue describing the Coppus Turbo-blower for



UNIVERSAL TOOL GRINDER.

undergrate draft and other industrial purposes. Up till comparatively recent times the chimney was the only practical way to get draft. The limitations and cost of a chimney brought about the use of mechanically operated apparatus. The use of the Coppus turbo-blower as a means of producing forced draft is fully dealt with, and the advantages of this system are explained. The blower consists of a propeller fan driven by a steam turbine, both mounted on the same shaft and located on the boiler front. The mechanical features of the blower are dealt with in detail; the lubricating system, ball bearings, construction of the steam strainer and the arrangement of the exhaust are all shown to good advantage. In a blower turbine driven, the construction of the turbine wheel demands careful design for economy and this construction is clearly developed. An interesting portion of the descriptive matter deals with typical applications to the various types of boilers.

THE ALBANY HIGH-SPEED DRILL

We illustrate herewith a high-speed tool-room drill, which contains several unique features. The makers of this drill, the Albany Hardware Specialty Manufacturing Co., Albany, Wis., claim for some of the advantages, rapidity in starting and stopping the spindle, changing drills and chucks, and changing speed, and also accuracy of drilling to depth. The drill has ten changes of speed, varying from 286 r.p.m. to 2,140

ALBANY HIGH SPEED DRILL

r.p.m. The capacity of the drill is from 0 to ½ inch holes, and to the centre of a 12-inch circle. The height overall is 72 inches. The spindle is driven by a friction wheel, which is driven by a cast iron hemisphere, engaging with a friction wheel on drive shaft. The hemisphere is carried on a pivot, and a lever is fastened to it so as to enable it to be moved in relation to the two friction wheels, thus varying the speed of the spindle. An index is provided on the lever quadrant. If the lever is pulled down to the lowest notch, the friction wheel on driving shaft will be running on the largest diameter of the cast iron hemisphere, while the friction wheel on spindle will be driven by the smallest part of the hemisphere's periphery. This combination will give the lowest speed, 286 r.p.m. The drive shaft is carried on radial ball bearings of the silent type, as is also the friction wheel. A positive depth stop is provided for duplicate drilling, so arranged that it does not lessen the spindle travel when not in use. The spindle has a vertical travel of 4½ inches and is finished with a micrometer depth gauge, graduated in English measure on one side, and metric measure on the other. It can be turned over to either side as required. A very complete description of the details is contained in a catalogue issued by the makers, which will be of interest to users of this type of tool.

WOMEN NAVAL ARCHITECTS

The entrance of women into many scientific activities has shown itself from time to time in an earnest desire to be given a status in the particular activity in which they have qualified themselves to become useful members. It is certainly a sign of the times when the Council of the Institution of Naval Architects is seeking to obtain the views of the various classes of members of the Institution on the subject of the admission of women to such class or classes of membership as they may, apart from the question of sex, be qualified for under the present rules of the institution. At the present time, women are not eligible under the existing rules covering the admission of candidates, and it is therefore necessary to alter such rules, which requires the assent of a two-thirds majority, and if this is obtained, the consent of the privy council to the corresponding alteration in the Royal Charter of Incorporation would have to be also obtained. It is understood that at the present moment there are only three ladies seeking admission into the institution, each of whom has received a technical training, and has been engaged in making calculations or carrying out experimental work connected with shipbuilding. One of these ladies is the joint author with a member of the institution, of a paper contributed to the present year's transactions, viz., "The effect of the longitudinal motion of a ship on its statical transverse stability," by Mr. G. S. Baker, O.B.E., and Miss E. M. Keary, and was read recently. If women are admitted they will only be admitted on the same qualifications which apply to the opposite sex.

RUST-PREVENTING VARNISH

Resin six parts, sandarac nine parts, gumlac three parts, turpentine six parts, and rectified alcohol nine parts. The resin, sandarac, and gumlac should be mixed together in a pounded condition and then carefully heated until melted. When they are well melted the turpentine should be added very gradually, stirring all the while. The mixture should then be digested until dissolution takes place. Then add rectified alcohol up to the amount stated above. It should afterwards be filtered through a fine cloth or thick filter paper, and preserved in well stoppered bottles so that no evaporation can take place.

SUGGESTION FROM WEST

A proposal that Alberta and Saskatchewan deposits of low-grade coal, which will not stand shipment by reason of its friability, be utilized for the generation of electricity for light and power, has been made to the Advisory Council for Industrial and Scientific Research by Hon. C. A. Dunning, provincial treasurer of Saskatchewan. The suggestion is that power houses be erected at the mine fields and the current be distributed to farmers and other consumers. The proposition has been referred to the council's lignite committee for investigation.

NICKEL PLATING BY RAPID PROCESS

Rapid plating is the rule in America. The common practice is to work at 10 to 20 amperes per square foot, using concentrated solutions, but this has been improved upon. It was found that high-grade commercial cobalt plating could be achieved in three minutes when working at 150 amps. per square foot, and a solution of 312 grammes of anhydrous cobalt sulphate per litre. The same practice was then applied to nickel plating, but it was found that the generation of acid cut down efficiency and produced hydrogen at the cathode. This difficulty has been overcome by adding a small quantity of chloride and heating the solution. This done, a 25-gallon nickel cast can be worked at 125 to 150 amperes per square foot, producing heavy, durable deposit in five minutes.

DRIVING BELT OF IRON WIRE

The shortage of leather and textile fibres suitable for making up into driving belts, has produced a new industry in Austria, which may be worth while noting. These belts are now made of iron wire in some instances in combination with paper twine. The standard type consists of double iron wire, spirally twisted together, and in part slightly copper-plated by a chemical process. They range up to about 10 cm. broad. Another sample is of wire gauze strips interlaced with one-ply and two-ply paper yarn, partly with single and partly with double threads. It is bound at the edges with paper yarn, then strongly impregnated with tar asphalt, and flattened out between rollers. A third sample is bound with iron wire spirally twisted.

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Leadership Needed Now

THERE are a number of organized bodies in Canada that have been making munitions. They have good organizations, good executives and good premises, and a certain amount of good machinery adaptable for any line of work.

The business of making necessary changes in the plant, of discarding the single purpose machinery and putting in other special machines, is not worrying them. They would do it in a minute if they were certain which way to turn. Many of these firms had no special lines before the war. Others had.

"What shall we make?" That is the question that is being asked, perhaps not openly, but certainly in the quiet of business councils, and it is the largest matters that is up for consideration just now.

It is a case in which individual initiative should be backed up by some central encouragement and control to prevent over-production along certain lines that may already be fairly well established here, and along others for which the market may yet be uncertain and problematical.

Well, What's the Use?

WHEN it comes to stating the case correctly the medal for this week goes to the scrap metal dealer, who stated to CANADIAN MACHINERY:—

> "What's the use of putting a price on stuff that you don't want to buy, and what's the sense in naming a figure when no person wants to buy what you've got to sell?"

It's much more interesting to have a man stick his thumbs in the place where sleeves should grow in a vest and size up the situation that way, than to have him look sideways from his desk and moan "Nothin' doing."

Canada is the second largest pulp and paper producing country in the world, and is rapidly overtaking the United States, which holds first place.

Some of the women who have been working around machine shops for the last three or four years will now be running the egg-beater by a contrivance hitched to the electric toaster, and washing dishes with the same foot power that runs the sewing machine.

The Industrial Slacker

A NEW post-war phrase is being developed in this country. It's not particularly choice, and it's not one that a person would go out of his path to claim.

The phrase is "industrial slacker."

When the voluntary plan of enlistment was in force in Canada, the word "slacker" came to the surface. It meant a person who was standing back and allowing others to fight for him—one who was getting from under his responsibility.

That slacker person had a rather serious time of it. He couldn't stand back and say "This war is no business of mine. I'll stand back and wash my hands of the whole affair."

And bear in mind there was much at stake. Public opinion wasn't forcing the military slacker to a southern summer resort. It wasn't asking him to go to a circus.

Rather was public opinion putting on the screws that ultimately would put that man in the stern path of duty. He risked everything—life, health, position, home. That's the path that public opinion mapped out for the military slacker.

Now, then, where does the industrial slacker come in?

The industrial slacker is the man or the company that is closing up its factory now and tossing its hundreds and thousands upon an unprepared labor market because it fears that some of its war profits will be lost by operating in doubtful circumstances in regard to present costs and future market.

The industrial slacker is the nation or the government that tells its returned men that their jobs have gone by the boards, while they were getting shot at to save the carpet-slipper moneymakers at home.

The industrial slacker is being urged to do his part as the military slacker was urged to do his. He is being asked only to risk dollars, while the military slacker was urged and hounded to risk all—dollars, life, limb—everything. The risk of the man who put on the uniform was a thousand times greater than the risk of the man who is asked now—to the Government that is asked now—to risk its dollars in order that this country shall get a footing on its after-war trade.

The Canadian Government should stand behind Canadian industry for the time. The Government helped to turn peace lines into a war machine, and it should participate in the process of bringing them back again to a peace basis.

The Canadian Government does not need to be stingy in the matter. Neither do many Canadian firms. In both cases they have money to back them up in any move they make.

Reconstruction doesn't consist of firing a thousand hands in a day; it doesn't consist in squabbles at Ottawa regarding which faction there won the war; nor does it consist in telling returned men that, having taken off the uniform, we have no further work for them to do.

Canada calls for men to be as brave with their dollars now as they expected others to be with their lives.

The concern that takes its war profits and clings tenaciously to them, fearing to launch out for fear of losing some of them, and all the time knows that it is playing the fool part in reconstruction is going to have a mighty hard job showing why the term "industrial slacker" should not be nailed on its front door.

Our idea of a calamity would be for a civic candidate to make a speech and be banned from using the phrase "in the best interest of the city."

The statement is made that certain drug stores in the flu epidemic shoved prices sky high. There's a heap of folks in this country reaching out after blood money.

HAS MADE A SUCCESS IN HIS LINE OF BUSINESS

Frederick E. Rejall Went Into the Selling Business and Has Made a Good Connection

FREDERICK E. REJALL, Canadian Manager, H. Boker & Co., Inc., Montreal, Que., Agents, Novo Steel Works, Sheffield, England, was born in Brooklyn, N. Y., 1880. After leaving High School he entered in the export and banking business with one of the oldest and largest houses in New York City. After a stay of fourteen years with this concern he was called by and made his entry into the steel business with the firm of H. Boker & Co., Inc., New York.

F. E. REJALL

He spent one year in the New York and Chicago territories, when under the personal schooling of J. R. Boker, then manager of the Steel Department and now president of the company, he received a thorough training, both as to salesmanship and the practical handling of their various lines.

His quick adaptability to the practical handling of tool steel, being his hobby since boyhood days, soon became apparent to his employers, to the extent of their sending him to the quaint himself with the manufacture and heat treatment Novo Steel Works in Sheffield, England, to further ac- of the output of this mill.

Here, under the direct supervision of B. W. Winder, chairman and managing director of the Novo Steel Works, an inventor of the first high speed steel, "Novo," assisted by Mr. J. K. Jonas, senior director, he gained much valuable information, both as to the adaptability and handling of the steels produced by this mill. After a short trip through Holland, Germany and France, he returned to New York.

His firm, realizing the great future of the development of the tool steel business in Canada, decided to enter into the Canadian market. In January, 1909, Mr. Rejall was chosen to represent his firm in Canada with the title of manager, and offices and warehouse were opened at 332 St. James St., Montreal, their present headquarters. Although his first six months in this field were exceedingly trying and at times almost discouraging, his untiring efforts, energy, and stick-at-it-ness, quickly brought the success that was bound to result, so the end of the first year showed a good balance on the profit side for his company.

His knowledge of his business, his congeniality, straightforwardness, and efforts to satisfy, have gained for him the esteem and highest confidence of the trade throughout Canada.

Prior to 1800 all paper was made of rags. Since that time wood-pulp has formed the basis for all the ordinary grades of paper, including that used for printing newspapers.

Canada's first large paper mill was built in 1865, and produced 1½ tons of paper in 24 hours. To-day a modern paper mill produces from 250 to 300 tons in the same length of time.

Speaking of Napoleon

IT'S over a hundred years ago since they fought at Waterloo, and took Napoleon by the snout and told 'im what to do.

You see he had been all puffed up, his head was out of joint—in fact it got so big at last 'twas near the busting point. The folks in them days wouldn't stand no sass from Bonaparte, so they kicked the jumpin' daylights out of his old apple cart.

They chased him round the clover crop and underneath the barn, and planted him out in the sea where he couldn't do no harm.

It's just a way the world has got with nations or with people, it's a mighty dangerous thing to do, this shoutin' from a steeple. As long as folks will stay at home and mind their own affairs, and keep from vexin' others with their high-falutin airs, they'll find this world a happy place chuck full of milk and honey, and peace that Midas couldn't get with all his mint of money.

And they can travel far and near, or stay right on the stubble, and go or vamoose to their taste without a speck of trouble.

But it's quite another thing, by gum, and there's miles of stuff to back it, that there's danger stickin' everywhere when you're searchin' for a racket. You can't go stampin' on pet corns, or jumpin' off the track, for when the deal comes round again they'll cut you from the pack.

It aint no use to buck this rule or put on injured airs —the safest thing for you to do is mind yer own affairs.

—ARK.

Why Is The Kaiser At Large?

AN outraged world should guard carefully against any pussy-footing that seeks to create a "go easy" attitude in dealing with the German nation, especially that part of it responsible for the war.

Now that the war is apparently over there is a decidedly pronounced sentiment toward tossing buckets of mercy on a people utterly undeserving of any consideration.

The German people are not repentant. Had they the power they would unloose their submarines again tomorrow.

The Huns who brought Hell to this earth, who drowned babes and butchered old men, have got to come before the jury of the Allied nations.

A Kaiser at large means trouble. It means plotting and intrigue. It means that one of the grossest miscarriages of justice the world has ever witnessed has been perpetrated. It means that the assassin has sidestepped the noose.

The Allied court should have some very direct sessions with William Hohenzollern. As things stand at present the murderer is still at large.

"Get out and sell" is taking the place now of "Go out and tell them that we can't promise delivery for a month yet."

Eggs used to sell at 3 dozen for a quarter. But then a quarter used to look as big as three dozen eggs in them days.

Some of the letters that are coming to Canadian homes now are "made in Germany." However, there's no kick about it, seeing that the victorious Canadians are there making them.

The surrender of the German fleet may have been a great event, but it dropped the estimation of the Germans down to zero in the popular mind. After all no person loves a quitter.

MARKET DEVELOPMENTS

Some Prices Show Inclination to Modify

All But One Contract For Munitions Has Been Cancelled and Settlements For Cancellations Are Now Discussed—Pittsburgh Looks For Short Dip in Steel Prices Before Recovery

CANCELLATION has been written upon nearly every munition contract in Canada. The 12-inch American shell went by the boards this week before the actual business of production had been commenced. Large machine tools were in turn cancelled by the firm holding the contract from the American Government. In several of these cancellations—in fact in most of them—it will be necessary to do some considerable readjusting. Only one shell contract stands in Canada now, and that is the 240-mm. shell, an American model, the contract being placed in Brantford. If Washington decides to let this contract stand this shop will be employed for some months to come as the order was for a large number of these tapered projectiles.

Prices of steel show an inclination to come down a little more in a few lines. The element of competition is coming more and more into every business deal that offers. Firms that have been looking askance at the smaller orders are now out after them, big or little. It all means a tendency to put the pruning hook into the price list, and this has been done, sheets and bars showing a few more cents off this week.

There is something peculiar in the way certain lines of industry have recovered their producing powers. For instance, the Canadian trade had been told that it was impossible to secure skelp to make tubes, and that there would be no help for it until after the war was over. Canadian warehouses find that immediately on the cessation of hostilities great quantities of tubes are being rushed along to them at war-time prices. The belief is that the mills were holding a strategic reserve all the time. The placing of these tubes in Canadian warehouses at high prices means that there will be a scampering now to dispose of them before a further decline in prices, and selling profits will be forgotten, the idea being to get from under with the high priced material.

Scrap metal business is poor. It was poor last week and it looks as though it would be poor for some time to come. Dealers are not offering on any available material, and users are not in the market for any considerable tonnage. The feeling seems to grow that there will have to be a readjustment of the iron and steel situation before there is much of an improvement in the scrap metal trade.

CANCELLED BUSINESS WILL NEED TO BE READJUSTED NOW

Special to CANADIAN MACHINERY

MONTREAL, Quebec, Dec. 11, 1918.—The approaching holiday season, coupled with the recognized unsettled condition of general trade, has been a factor in continuing the nervousness shown during the past few weeks. Plants in this district that have been working on shell contracts, are gradually bringing their operations to a close, and within the next two weeks all work will be finished. Future work in these plants is more or less obscured at present, and few will give a decided answer as to their early activities. Steel mills in this district are still quite busy, but booked orders are lighter. It is very apparent that little activity will develop in any line before the turn of the year. The machine tool business is exceptionally quiet, notably in the placement for new equipment. Virtually, nothing is doing in old materials.

Little Buying for Futures

Uncertainty and hesitation are two of the chief characteristics in the present unsettled situation. The general demand for material is very quiet, but less difficulty is experienced in obtaining shipments of supplies. The market is virtually free of control features but with the high prices still effective possible buyers are reluctant to enter the field. Apart from the few cancellations that are reported, the mills are quite active, and the shock that might have been expected by theh sudden stopping of hostilities has, as yet, not been seriously felt in this direction. Of course the volume of business that is now being placed is considerably less than that of a few months back, but sufficient business is now on the books to maintain operations for many weeks hence. It is probable that the market will be free from all restrictions at the beginning of the year but it is unlikely that any sudden break will result in prices. The ship and car programme is still heavy, and the present demand for plates offers little relief for domestic purposes. This, however, will gradually right itself, and before the winter is over more normal conditions will prevail. It is believed that heavy buying will eventually figure in the steel situation, but consumers are apparently not anxious to cover future requirements at present high prices. What business is passing is for immediate needs only. Prices are firm and unchanged at last week's quotations.

Lead Prices Decline

Little of interest is passing in the metal markets, but the volume of business is sufficient to maintain the optimism generally shown throughout the trade. Copper is firm on quieter demand with castings one cent easier than last week, the present price being 28½ cents per pound. Tin is steady on a fair demand. The lower market in London has not seriously affected the local situation but the prospects are for lower quotations early in the new year. The lower price in the States has reacted on lead here and a decline of one cent is noted, the current quotation being 9½ cents per pound. Antimony and aluminum are both unchanged at 12 cents and 46 cents respectively.

Machine tool dealers are having a

holiday at the present time owing to the almost negative demand for equipment. The cessation of munitions making has eliminated the need for shell machinery, and activity for ordinary requirements is not expected until the readjustment period is well advanced. One of the problems confronting the trade at present is the settlement in connection with the cancellation of such tools as are in process of manufacture. Where considerable work has already been done on special machines the difficulty is more pronounced. This, however, does not apply to standard equipment and it is reported that work of this class of tool is proceeding as usual. While second-hand equipment is a little more plentiful there is not the volume that might be expected from the closing down of so many munition plants. This is largely due to the fact that the bulk of existing shell machinery is of a special character and adaptable exclusively to the purpose for which it was built. Many plants are holding on to their standard equipment, not knowing what may develop in the near future. Supply demand is very light, but in general the prices are well maintained.

Scrap Movement Quiet

Despite the marked decline in many lines of scrap and old materials last week the situation has remained very quiet, and trading is confined to supplying small quantities of material for immediate requirements. Dealers here are not anxious to accept old material for stock at prevailing prices, and purchases are invariably made at figures lower than those quoted, these being more nominal than actual. No further change has been made in quotations here and the market is expected to be dull for some time.

THEY ARE GOING AFTER TRADE NOW

And Prices Show Inclination to Fall Off In Some Lines Of Steel

TORONTO.—A softening of prices in several lines of steel products, a little more competitive selling, inquiries for lines that had been out of existence for some months—these things feature the Toronto market situation this week. Although none of them are outstandingly marked, still they indicate the direction of trade.

The Machine Tool Trade

Machine tool dealers in Toronto claim that they have not much single purpose machinery in their warehouses, and that a number of plants that they have taken over on the expiration of contracts contained a large percentage of general purpose tools. Cancellations of 12-inch American contracts this week brought in its trail cancellations amounting to some thousands—a good many in fact. That just about ends the munitions business in Canada. In fact about the only contract still living is that for the 240 mm. Motor Trucks at Brantford have that, and if this shop goes along with the work it will be a bit of souvenir in the industry that before long will be only a memory of quantity production and high wages.

One dealer stated this morning that his firm was receiving inquiries for equipment from several centres, and that business was beginning to take on a peace-time appearance. Some of the inquiries promised to run into considerable money. Of course, it will take a long time for this business to grow into the volumes that have been handled by the machine tool dealers in the last few months.

The supply business is smaller in volume this week. A number of decisions will have to be made regarding what lines are to be followed by Canadian manufacturers before there is much of a revival in this business.

The Steel Situation

The mills are not accepting cancellations from the Canadian trade, neither are they considering any price adjustments. As a consequence there is a considerable tonnage coming forward to the warehouses at old prices. The result is that there is going to be an effort on the part of the warehouses, on the arrival of these goods, to dispose of them as quickly as possible. The same rules hold in steel as in any other form of merchandising, and it means in reality that pricecutting will be indulged in. As a matter of fact there have been a number of deals put through in the last few days which show a tendency on the part of the dealers to get rid of their stock at the best price obtainable. Of course, this must not be taken to mean that the skids are under any considerable number of lines, but rather that the old business of competitive selling is again being felt.

"Simply as a matter of form." That seems to indicate the feeling towards the securing of permits from the war trade for orders that are being put through now. There is little delay in getting orders through, and the feeling here is that the whole business of government regulation and allotment is right now living on borrowed life, and is apt to go by the boards almost any time.

A Peculiar Situation

Tubes are coming forward to Canadian dealers in large lots. In fact they can get all the tubes they want now, and almost any kind, or size. Some of those interested in the trade are rather skeptical about the remarkable recovery that is being made in the ability of the mills to furnish the supplies of tubes to Canadian dealers. The tube situation was bad for a good many months. In fact it was impossible to secure a two-inch tube and they were badly needed for repair work. Canadian dealers were told, when they approached the mills on the other side, that it was impossible to give them the stocks they required. Their mills were entirely on war work, and furthermore it was impossible to secure skelp to send to the rollers as the metal was passing through the open hearths to other purposes. Now, almost the day or week that the armistice is signed, the Canadian dealers are informed that their orders, accumulations of weeks or months, are on the road. Certain it is that the tube rollers could not have recovered so rapidly, and it looks as though they had been keeping a strategic reserve against a bad day, and that the Canadian dealers were now being avalanched from this. These tubes are coming in at a fairly high price, and, of course, there will be more or less of a scramble to place them before the era of high values has become a memory. They will likely be sold at a price very close to cost in many cases.

Some Price Changes

As each week, some months ago, saw prices another rung or so up the ladder, so each week now sees the prices crawling down again to levels approaching reason and stability. Sheets (28B) are this week quoted at $7.50 hundred. Last week they were at $8, and not long before that they were trading at $9, and even a little better in some cases. The chances seem to be that they will hang

POINTS IN WEEK'S MARKETING NOTES

The scrap metal trade continues in a state of stagnation in Canada. No sales of any size are being made. Yards are well stocked, in some cases with goods bought at prices that cannot be realized in selling.

Prices of steel sheets and steel bars are down slightly again from last week's quotations.

There is a good deal more competition now for any business that is offering to the warehousing firms.

The contracts of the 12-inch naval shells have been cancelled by the U.S. Government. This leaves only the 240 mm. contracts for the U.S. Government, and this order is in the shop of Motor Trucks, Ltd., Brantford.

Dealers in wood working machinery report more inquiries from a wide radius than has been the case for some months.

Trade expects that the whole system of government permits for steel will be done away with in the very near future. Permits are still obtained simply as a matter of fact.

Pittsburgh experts figure that steel prices are due for a dip shortly after fixed prices run out at the end of the year. After that a buying rally at the reduced values will start a real boom at the steel mills.

up around the $7 or $7.50 mark. Steel bars are quoted down a little, $5 against $5.50, and iron bars, $4.90 against $5.25. Small shapes, and this heading includes a large variety of material, is placed 25c per hundred down at $5.50 against the $5.75 that has held for some months.

Dealers state that the demand for steel goods is brisk. Business that has been neglected for a long time is coming to life. Apparently the demands come from industries affected principally by the trade of the mines, agriculture and ship building.

Scrap Trade the Same

It may be that the Canadian scrap metal trade is waiting for the U.S. market to make a start. The U.S. market in turn is waiting for the end of the present quarter to run out, as prices are fixed by the Government up to that time, and present demand does not warrant the paying of the limits unless there is a case of real need and quick disposal in connection with the deal.

At any rate conditions in the scrap trade in Canada are almost stagnant. Last week Montreal dealers came out and cut the prices they would offer by big margins. Lines that had been holding around $24 per hundred were brought down to around the $15 mark, but apparently that made little difference. Buyers are not found at either price. As one of the dealers in Toronto stated this morning, "What's the use of naming a price at which you will buy when you don't want to buy anything, and what's the use naming a figure at which you will sell when there's no one in sight who wants to buy?" Well that just about represents the case here at present, and there is nothing in sight at the moment to indicate that a period of greater activity is in sight. Yards are well stocked, too well in fact, and for the present nothing is moving.

SCRAP DEALERS WAITING FOR IRON AND STEEL MARKET TO SETTLE

THE scrap metal market last week was described as stagnant, and this week a phrase that would fit the situation would be more stagnant. This condition is the same on either side of the international line. Canadian dealers who used to find an outlet for much of their yard tonnage in the American markets are finding no such outlet now. Buyers at U. S. points are not any more anxious for material than they are here. Prices have much to do with the difficulty. These have been for some time at the maximum allowed by the Government. There is a strong tendency now to get away from these, and in this condition much trading is not looked for. Reports from American points give the following:

Chicago—Prices are unsettled here, as there is almost no trading on which to form an opinion. Many of the smaller dealers are out now offering much of their material to the consumers at concessions, but they are not meeting with response even on these grounds.

Pittsburgh—Present Government prices are effective only until the end of the year, and no person is buying in the meantime. Cancellations are made wherever there is any chance, and users are becoming more strict than ever in their inspections, and if the metal is not right up to scratch the rejection of the shipment is certain to follow.

Buffalo—The trade here seems to incline to the belief that all Government control will disappear at the close of the year, and it seems to be the opinion of nearly all that an all-round reduction of $5 per ton will be certain. Both mills and scrap men are waiting for developments.

Cleveland—Dealers are positive in their statements that they will not contract for any material before the first of the year. When the free market comes a break in the prices is looked for. Cancellations show a strong inclination to become more numerous, and although the tonnage affected yet is not very large, a continuation of the tendency might become rather embarrassing.

St. Louis—Sharp cuts were made in the price of many lines here this week. But even the whittled prices hardly represent the real value of material at present. Neither has the cut had the effect of stimulating trade. A few weeks ago dealers claimed that they were shy of all grades of scrap, but as soon as the war ceased they all turned out to have very large offerings to place on the market. They had loaded up at fairly high prices and now they are scampering to unload before the sag in the market becomes any more pronounced.

Birmingham—Dealers here have their own way of figuring out the situation. They hold that not until there has been a settlement of the steel and iron situation will there be any betterment in the scrap business. In any trading that does take place consumers simply make their own bids regardless of price lists.

STEEL PRICES WILL TAKE DIP BEFORE BRISK BUYING STARTS

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Dec. 12. — The opinion expressed in last report that there will be no further price fixing is now confirmed and only the final formal announcement is needed to wind up the obituary of Government price control. The War Industries Board and the iron and steel industry independently reached the same conclusion, that price fixing should be discontinued. There appeared to be some weight to the idea of some measure of control of prices during the transitionary period, so as to avoid a slump in prices, but the War Industries Board found itself powerless to enforce minimum prices, to prevent sellers from shading, while the producers felt that in the long run they would be better off if the market were allowed from the very outset to take its own course. One cogent reason for the producers' attitude was that if the War Industries Board should set prices for the first quarter of the new year it would probably insist upon reductions as it would not be readjusting the market if it did not make at least a start, whereas the producers might be able to hold the old prices for a time.

Immediate Decline Improbable

While the situation created by the sudden disappearance of Government control—although, of course, the present agreement runs through December 31, which is not far off—appears to be an entirely new one it is not new after all. It is in substance the same situation that has always developed after there has been a rise in the market and the corresponding decline is in prospect. The market moves through cycles, which are very much the same in character, although differing in length and in the intensity of the movement. Starting with a period of low prices, demand develops, prices begin to ascend and buyers become confident. They buy more and more freely and thus encourage prices to rise further. When prices stop advancing the buyers find themselves well covered and cease buying. Then the producers hold prices as long as possible, shipping on old orders and booking such little additional business for early delivery as develops. No large sales can be effected on a declining market, hence the incentive to the producer is to hold prices, for there is more profit for him in the contracts he has on books than there would be in the little business he could pick up by cutting prices. When order books are pretty well cleaned out the sellers begin cutting prices and the decline occurs. Beginning with the boom of 1899 this cycle has been run through five times, the peaks of demand and prices falling in 1899, 1902, 1907, 1909 and 1912. Afterwards in each case, there was a period of sustained prices with little buying, but heavy shipments. After 1899 and 1902 the old pools and associations helped to sustain the market, and in 1908 the "Gary dinner" movement was a great help, but the underlying incentive to the individual producer, not to cut prices, was always present. The artificial assistance given, as by the Gary dinners, merely helped.

In its general form, the situation today is precisely similar to those experienced in the past. The furnaces and mills have a large volume of contract business on books, and there is a fair, though decidedly moderate, running demand in the aggregate for early deliveries, from buyers to whom price is no particular object because they expect to turn the material over at once. If the market is going to decline eventually, they do not wait, because then they can buy more material and turn it over also. In this class are the jobbers and automobile builders, for instance.

As to the contract business on books, some of the contracts are absolutely firm contracts when, for instance, they are for specific buildings or bridges, or specific lots of railroad cars. About this business there is practically no question; it must be carried out. Other contract business is not so firm, and the buyers under the contracts may be altogether unwilling to promise that they will take out the entire contract tonnage, which might involve a period of many months, but they are in many cases calling for immediate deliveries. They may be urgently desiring such and such tonnage deliveries for January, and perhaps also for February, and that affords business for producers even though there is no assurance as to whether these same buyers will want material in March at the contract price.

Little Construction Work

There is little construction work in prospect for the near future. There is practically nothing by way of entirely new projects, and as to old projects, set aside by the war, the buyers in many cases are at the mercy of the labor market and the market for other commodities, needed in conjunction with the steel. There is specific information as to several such projects, where large tonnages of steel have been under contract for months, and the buyers now tell the mills they will want the steel as soon as they can secure labor to utilize it. Just when that will be they do not know, but they are anxious to go ahead.

As to new projects, little can be expected for a time. Regular investment buyers, who would build factories, bridges, hotel and office buildings, cannot take hold now for they require assurance as to costs. They cannot make their investments at high costs if costs are shortly to be lower. It is not merely a question of the cost of steel, for the cost of utilizing the steel, by buying other construction materials and employing labor, is a large item in most cases, and if steel came down to an entirely satisfactory level at once these investors would still have to wait for their other costs to come down, or for assurance that costs were not going to come down. Accordingly, the iron and steel producers do not see that it would help matters in any way, while it would hurt the situation in several respects, for there to be an immediate and material decline in prices.

Market Prospects

It is barely possible, of course, that there will be declines immediately after January 1, but it is much more probable that existing prices will be held for a time, perhaps a few weeks, perhaps several months. Meanwhile the buyers who can afford to take the risk of buying at present prices, because they can turn over the material promptly, will be over their rush and much of the contract business will be worked off. Production will doubtless decline, perhaps very materially. Finally, when prospects appear ripe that heavy buying for forward delivery can be induced, producers will be ready to meet buyers' ideas, by dropping the market, and there is likely to be a dip to such an extent that it will be followed promptly by a recovery, and then the period of prosperity, probably of several years' duration, will be upon the trade.

CANCELLATIONS ARE NOT BEING ACCEPTED BY PIG IRON MAKERS

THE question of cancellation of contracts is occupying considerable attention among the producers of pig iron in the United States. The situation is a rather peculiar one. Many orders were placed on the books of the companies, the price to be the Government standard at the time of delivery. Now that the furnaces can supply this material, in many cases the demand for it has been withdrawn, or in other cases the users want to hold back and see if the market will work toward a lower level before they place their orders. Cancellations are not being accepted, and in some places iron is piling up on shops faster than they can hope to use it. Their only recourse will be to come on the Government for loss. Following are some of the reports from leading production centres in the States:

Chicago—In no case reported here has there been a cancellation on gray iron. Cancellations for any kind of iron are not being accepted. Some requests for cancellation ask for a bill of expense for work done on the order up to the time of cancellation, in order that the matter may be taken up with the Government. Sellers refuse to do this, advising that melters sell their iron on the market and charge back the loss to the Government. The idea is that the market will be disturbed less in this way.

New York—There have been quite a number of requests made in this district for cancellation, but the furnaces are standing pat and refuse to move in this direction. Furnaces remind the trade that in the summer of 1917, when pig was selling at $50 and $55 per ton, they kept on filling old contracts at as much at $20 below that mark, and now that the tables have been reversed, they hold that it is up to the melters to keep faith with the sellers. Makers of pig are emphatic in their stand that contractors for iron must take their deliveries.

Buffalo—Small tonnages for early shipment form a good deal of the new business that is coming to the furnaces here. Furnaces which are not soliciting business are those which are going ahead on the allocations made by the Government prior to the cessation of the war. Coke shipments have been more satisfactory than for some time past.

St. Louis—Makers of pig iron in this district are satisfied with the prospects for business in the future. Those who expected that there would be a cancellation on a large scale are out in their guess, for many of the firms that were getting iron on allocation are just as keen to get it now as though the war were going to last for a year. Peace plants are coming to life much sooner than was thought possible. Construction work is about the only line that has not begun to take on definite form.

Cincinnati—Although it was hoped that the end had been seen of cancellation requests they continue to come in. Against this there is reported new business from firms making agricultural implements, although the volume of this trade is not as great as that which is being dropped. Foundries casting for machine tools are in a poor way, as they have no outlet for the pig iron that is piling up on them. At present they are storing for future use.

Philadelphia—Cancellation by the British Government of an allocation of 100,000 tons of basic is causing some worry among the dealers here, and a meeting may be held to consider the whole matter. There is another matter of trouble. Sellers booked orders months ago that they plan to fill now, and they are wondering if they can hold users up to prices should the Government regulations be done away with before delivery is made.

Pittsburgh—Many furnace men hold the belief that the dropping of Government control will mean higher prices. They point to the fact that production costs are steadily rising, and that there are stacks that at present prices are not doing better than breaking even.

NEW ADDITION TO THE GALT FOUNDRY

Galt.—As another evidence of the continuous growth of Galt's industries, particularly on the east side of the city, the Galt Foundry Company, situated on Beverly street near the C.P.R. subway, who specialize in the manufacture of sprinkler stokers, have found it necessary, owing to the large extension of their business, to erect a new machine shop, operations having already commenced on the building, the dimensions of which are 65 by 60 feet and 20 feet in height. The manager, Mr. W. M. McRobert, stated that the company would eventually build a new factory, as there was every prospect of the business growing to large dimensions in the near future. With the present addition to the plant, it will be necessary to take on a number of extra employees.

Other industrial establishments in this locality who have built additions to their plants within the past twelve months, are the Galt Brass Company, macadamized road; the Roelofson Machine Tool Company, and the Galt Machine Screw Company, the two latter also situated on Beverly street.

THE WEEK IN INDUSTRIAL HAMILTON

Special to CANADIAN MACHINERY

Hamilton, Dec. 12.—The Smart-Turner Machine Company, who have been manufacturing steel barrels for the last four years, state that the barrel industry is rather a strange one to handle, inasmuch as it varied from the regular business, by the fact of the orders coming into the plants in the early months of the spring and summer, and that business was almost at a standstill during the winter months.

The backbone of the barrel business is in the welders, who are large salaried men, and who demand a year's work. In order to keep the welders, so as to have them in the time of need, it is necessary to find some occupation for them, where they can earn their wages during the almost idle period of the industry. Last winter the welders in the Smart-Turner plant were engaged for a portion of the time in laying new floors in the factory, and machine shop, and repairing machinery, and odd jobs in welding, and the few odd orders for barrels that might be received.

In 1915 the Smart-Turner Company received an order from the Imperial Munition Board for 24,000 barrels, which were to be made of 14 gauge sheet iron, and to be filled with oleum for shipment overseas. During the year this order was filled, under the direction of Jack Howard, then superintendent of the factory. The order enabled the firm to instal an up-to-date barrel shop, but in 1916 they had the shop and no barrel business. In 1917-18 they began to work up a business, and during those years received their share of the barrels which were purchased in Canada.

The number of barrels that are consumed annually is very small, stated Mr. Smart. In the Dominion of Canada the consumption is almost limited to three companies, the British American Oil Co., the Canadian Oil Co., and the Imperial Oil Co. One of these firms in 1918 made very small purchase, while the others were limited in the numbers that they stocked. This may be due to the fact that several oil companies are themselves interested in barrel manufacturing.

The Standard Oil Company in the United States manufacture more barrels than their own consumption, and supply barrels to the firms with whom they are associated, thus the Canadian manufacturer cannot compete with the Standard people. The wooden barrel has by no means become a thing of the past, is the statement made, as a matter of fact they are still being used extensively by the oil companies and others.

The barrel trade has had queer turns in it, according to those who have been closely associated with the industry. It is stated that requests have been made from firms in South Africa and Italy, that barrels be made by the Smart-Turner firm, and be forwarded to a refining company to be filled with oil, gasoline, acid, or some other commodity. In event of the firm taking this in hand it would change them from the barrel manufacturing business into that of a broker or oil company. Under pre-war conditions it was possible to carry out these instructions, but due to the increased freight rates, the advanced price of the contents required for the barrels, the matter of export became almost impossible.

Export Not Feasible

The question of exporting barrels is one that has been deeply considered, and investigated. The firm have found that due to the difficulty in shipping that it is not a feasible idea. Shipping space is sold by cubic space and weight, whichever is the larger. In order to hold down the shipping charges, and to supply weight in order that the vessel will become seaworthy, the barrels have to be filled, thus the contents of the barrel becomes many times more valuable than the barrel itself. Great difficulty was experienced by the Imperial Munition Board in shipping barrels overseas. They required that the barrels be filled with oleum, a very strong sulphuric acid which, when mixed with water, eats into metal at a very rapid rate.

At the port of St. John, some time ago, a large number of barrels made by an American firm, from a light gauge of metal, filled with oleum, were loaded into a ship for export to England. In some manner, it is not known how, a quantity of oleum and water were mixed, with the result of it eating through the metal and the contents of several barrels spreading over the others, placed close to each other, resulted in large holes being eaten in the barrels, and the oleum again came in contact with water in the bottom of the ship, and its action eat holes in the bottom of the boat to such an extent that the ship began to sink at its moorings in the harbor, and was only saved from submerging by being brought back to a dock and being tied there.

This resulted in the Imperial Munition Board instructing that their barrels be made of a heavier gauge. However, they have not shipped any further consignments of oleum, but filled the barrels with other fluids required overseas.

It is upon these grounds and many others that have been brought to the attention of Mr. Smart that he has arrived at the decision that the steel barrel as an export product is not a profitable one, and on the facts that the number of barrels used in Canada is limited, that he makes the statement that there is not enough barrel business in Canada to keep all the barrel shops in constant operation.

The Labor Situation

The labor situation has been greatly relieved in this city, during the past several weeks. An example is demonstrated in the fact that a local concern advertised for a man to fill a vacancy on their staff and received 106 applications for the position. The same firm advertised for the same class of man about a month ago, and received only one applicant.

The large numbers of troops who are being demobilized is said by local concerns to be the cause of the labor flood. Many men are now looking the daily want ads. over for a position. Some applicants are not out of employment, but are on munition work and are seeking to secure permanent positions before the respective firms they are working for close down on munition work. The shortage of expert mechanics is still in effect, however.

Orders Cancelled

The Canadian Cartridge Company at Hamilton, who announced that they were to enter into the field, manufacturing all small steel vessels, exclusive of the boiler trade, and who had an order from the Imperial Government for 3,000 barrels, have announced that the order has been cancelled, and that at the present time they have no orders on their books for any kind of metal receptacles. Mr. Cook, superintendent of the factory, stated that he did not know when the company would commence operations along the line of their new proposed product. Over $100,000 has been invested in machinery to proceed with the manufacturing of steel barrels.

MAKING PUMPS

A very large number of pumps are being made by the Smart-Turner Company for the Embarkation Service of the United States Government. The sizes that are being erected are 10 x 6 x 12 Vertical Simplex, brass fitted, and 4½ x 4 x 6 Vertical Simplex. These are to be used on mine planters and river steamers in the service of the United States Government. The order is large enough to keep the Smart-Turner factory engaged in their exclusive manufacture until the end of February, 1919.

"Bang!" went the rifles at the manoeuvres. The pretty girl screamed a surprised little scream and stepped backwards into the arms of a young man.

"Oh!" she said, blushing. "I was frightened by the rifles. I beg your pardon."

"Not at all," said the young man. "Let's go over and watch the artillery."

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	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	.....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 40

Government prices.

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Steel bars, base, Toronto	4 90
Steel bars, base, Toronto	5 00
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	4 55
Steel bars, base, Montreal	5 05
Reinforcing bars, base	4 50
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Brand steel, No. 10 gauge, base	5 05
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50

F.O.B., Toronto Warehouse

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

Per 100 lbs.

	C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 31 00	$ 29 50
Electro copper	31 00	29 50
Castings, copper	28 50	28 50
Tin	83 00	88 00
Spelter	10 50	11 00
Lead	9 50	10 00
Antimony	12 00	16 00
Aluminum	46 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 8 00	$ 8 00
Plates, 3-16 in.	8 50	8 40

WROUGHT PIPE

Price List No. 37

Standard Buttweld

Per 100 feet

	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

	Black	Galvanized
2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$15 00	$20 00
Copper, crucible	18 50	24 50
Copper, heavy	18 50	24 50
Copper, wire	18 50	24 00
No. 1 machine composition	19 00	22 00
New brass cuttings	10 00	15 50
Red brass turnings	13 00	18 00
Yellow brass turnings	9 00	13 00
Light brass	7 00	9 50
Medium brass	9 00	12 00
Heavy melting steel	20 00	22 00
Shell turnings	9 00	12 00
Boiler plate	21 00	20 00
Axles, wrought iron	32 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	30 00	33 00
Malleable scrap	25 00	20 00
Pipe wrought	18 00	17 00
Car wheels	38 00	30 00
Steel axles	34 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	22 00	19 00
Cast boring	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	6 00	8 00
Tea lead	5 50	5 75
Aluminum	16 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 60%

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	$ 8 00	$ 8 00
Sheets, black, No. 10	10 00	8 50
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright	9 50	10 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.	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN
B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	...
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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CANADIAN MACHINERY
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Volume XX. No. 25. December 19, 1918

Re-Educated Soldiers in the Machine Trade

Vocational Re-education, Together With Artificial Limbs, Make the Injured Soldier Entirely Self-supporting and Enables Him in Many Cases to Earn More Than in Pre-war Days

By KATHARINE FREEMAN

THE old idea of supporting the cripple through charity has been uprooted and the public made to understand the idea of re-construction and re-education. When we hear of a man whose earning capacity has been increased since his injury, we feel that the work of reconstruction is an assured success. One such story is of a mechanic, who was wounded while serving in the Princess Pat regiment. He was sent back to Canada, spent three months in a convalescent hospital, and is now earning twice as much as he earned before. He is now foreman of a machine shop.

According to the Vocational Rehabilitation Act recently enacted by Congress, those disabled in the military and naval forces of the United States have been placed under the joint authority of the Surgeon General of the Army and the Federal Board for Vocational Education. The Surgeon General has jurisdiction from the time the person is injured until he is restored to good physical condition, when he receives his honorable discharge from the service. The Federal Board then offers him vocational re-education and training, which will enable him to return to useful active employment, and the U. S. Employment Service will find him a job.

The method is first to supply the cripple with a mechanical device in place of the missing arm and leg, then to thoroughly train him to use these substitutes in the performance of his work. The number of positions open to the cripple is far greater than a person who has not given thought to the problem would expect. Any man, who is able to get about on artificial legs, can do all but the heaviest work in machine shops. A man with one arm can do lathe work, drill press work, milling machine work and planing. Many of the processes performed in a machine shop are heavy, but there are also many which are light. It has been found that there are fifteen which can be performed by a disabled man.

TEACHING THE RETURNED SOLDIER THE USE OF OXY-ACETYLENE APPARATUS

Men having minor injuries of the body, but capable of standing, and having both hands, can still perform the following processes: drilling, grinding, milling, light planing, shaping, boring, screwing, sawing, operating of power press and capstan lathes. In the skilled trades, coppersmithing offers an opportunity to a man crippled in certain respects. Free movement of the body, however, is necessary as well as the use of both arms. Cripples are qualified to perform the operations of fitting, turning, brass finishing and moulding. For patternmaking a man must have good eyesight, although the loss of one eye would not make the work at all impossible for him. Oxy-acetylene cutting and welding is a vocation which furnishse one of the best opportunities for the re-education of disabled soldiers. They can be trained in oxy-acetylene cutting and welding so that at the end of three months they are self - suporting. Moreover, the demand for welders greatly exceeds the supply. In addition to all this, the industry has ahead of it such a future as few can look forward to.

The super-minds of the country may be developed among the war cripples, if experiments now in progress bear results. Students of the amazing psychological changes brought about by the loss of an arm or a leg are looking for surprising things from these researches. The surface of the possibilities has only been scratched, as yet, but the observations so far are more than encouraging.

The idea that a wonderful brain de-

RECEIVING TRAINING IN THE USE OF OXY-ACETYLENE WELDING APPARATUS.

velopment may be possible for cripples is based upon the known fact that the loss of one sense quickens another. A blind man usually develops a startling sense of touch. The amputation of an arm or a leg also produces, in many cases, an increased brain activity. A recent case in point is that of a cripple whose inventiveness brought him a comfortable fortune.

It appears that many nervous persons who have undergone an amputation operation become patient, careful and painstaking, which results in an improved output of work. Men who were once rovers declare that they no longer feel the roaming spirit. These and many other altered characteristics point to the fact that a radical mental change takes place in the individual after he has lost a portion of his physical self.

While public interest is easily focussed on the war cripple, it is not so easily directed sympathetically to the case of the workmen who are injured in the shops. These cases have been so common that they have attracted little attention. Yet they greatly outnumber the cases of soldiers permanently hurt in battle.

The advisability of including them in the government program of caring for the injured among the military forces, has been brought to the attention of Congress. It is quite possible that something will be done along these lines. These industrial cripples are quite as able to work, if properly re-educated, as the soldier. The matter is one which is already receiving considerable attention among progressive business men.

The urgent need for developing the iron and steel industry of the province was emphasized by C. F. Law, chairman of the mining bureau of the Vancouver Board of Trade, in speaking to the provincial convention of the British Columbia Boards of Trade at Vancouver.

ELECTRIC STEEL FURNACES

Before the war was many months old, armament makers found themselves accumulating huge quantities of borings, turnings, screwings, etc. of high-grade steel, produced chiefly in the process of boring and planing shells and guns. In ordinary times these turnings, etc., were of comparatively little value, although they contained chrome, nickel, and other costly elements. The real difficulty was to remelt them without losing these valuable contents. When the munitions works began to make enormous quantities of these turnings it was realized that the best way of utilizing them and of economizing steel was afforded by the electric process of melting, or remelting or refining. Admittedly there was no really perfect electric furnace of large dimensions on the market; but it was recognized that by the electric process it was possible to remelt without losing a large percentage of the alloying metals. All the nickel and almost all the chrome could be saved, and the turnings thus converted into first-rate steel. Sheffield, which had stuck tenaciously to its crucible, was specially interested in this scrap problem, and several local engineers and metallurgists turned their attention to the improvement of the electric process. The result that two types of purely Sheffield-invented electric furnaces have been put on the market and are being widely adopted, while other types are being employed on a great scale and are being constantly improved.

In briefly describing these Sheffield furnaces—the Greaves-Etchells and the Stobie types—there is no intention to ignore the virtues of others. However, it may be said that until their introduction there was no type of electric furnace of any considerable size that could melt more than a limited percentage of turnings per heat. Large quantities of new raw materials, such as pig iron, bar iron, etc., had to be used along with the turnings and similar scrap. Now, it is possible to have "boils" of as much as 12 or 15 tons entirely of scrap, such as turnings, against a limit of about 2½ tons before the war. This great development in electric melting will no doubt stand out as one of the most important metallurgical events of the war, and as a mark in steel trade history second only to the discovery of the Bessemer process. These large electric furnaces can turn out steel which makes sound ingots, and at less cost than the crucible process, though it may be a long time before the crucible is discarded for the making of tool and other special steels. The electric furnace, indeed, may simply prove a valuable addition to the crucible and the converter, just as the electric light has to gas, without displacing it.

The joint inventors of the Greaves-Etchell electric furnace are both Sheffield men, the former an electrical engineer and the latter a metallurgist. The furnaces are made in sizes of ½, 1½, 3, 6, 9, and 12 tons capacity. The smaller sizes can run a charge every 2½ hours, or nine charges a day, giving an output equal to 36 crucibles of 56 lb., and they can be operated by one skilled man, one unskilled man, and a boy for the ammeter, against 15 men for the crucibles. Again, the cost of renewals is much less with the electric than with the crucibles, and the space occupied is also smaller. This type of furnace is finding favor in America as well as at home.

Mr. Stobie, another Sheffield man, has aimed at eliminating the chief defects in the larger types of furnace. Previously electric furnaces of any considerable size were apt to suffer from localization of heat to the region of the arcs, rapid destruction of the roof, cutting away of the electrode holes, rapid tapering of the electrodes, and quick loss of heat after tapping. These defects were mainly due to the difficulty of stopping up the gaps around the electrodes where these passed through the roof. The Stobie furnace can be completely sealed up, and as there is no chimney effect no cold air is drawn. A reducing or carbon depositing atmosphere is constantly present. All surface combustion is arrested. The whole of the original sectional area of the electrodes is available for carrying current. The electrodes are of small diameter. There is no heat loss and no waste of current from escaping flame. The electrode holders and gear keep cool without water-coolers. The workers are not subjected to excessive heat. After tapping, the heat is retained as in the open-hearth furnace.—"Engineering Supplement, London Times."

Shovels Made Out of Old Locomotive Tires

Scarcity of Plate—Demand For Shovels and Availability of Scrap Materials Result in New Use For Locomotive Tires With Higher Quality of Finished Product

By W. S. STANDIFORD

THE great world war has created an unusually heavy demand for shovels as they are used in the trenches abroad as well as in the training camps. As a result, mills and factories are rushed with orders for these useful implements which they are endeavoring to fill. Shovels are made out of steel plate, produced by the aid of rolls, which wear out rapidly and require replacement. In these days of railroad embargoes and roll foundries being so swamped with orders, it is impossible to get new rolls made in less than three months. The problems faced by the manufacturer of shovels to keep his output up to its maximum is a very serious one. The demand for steel bars to make the plates out of, is also very heavy, and being out of proportion to the amounts rolled, also causes delays in shovel shipments.

The use of waste materials and their conversion into various useful articles having different shapes, is receiving the attention of various mill and factory managers as it is realized that a considerable saving of money can be effected by purchasing old worn metal, and re-rolling it to the desired sections. Worn steel locomotive tires that have outlived their usefulness in that particular field, when rolled into shovel plate, make most excellent shovels, as the quality of the steel is of a very high grade and better suited to the rough usage that the average shovel receives, than one made out of new steel containing a lower carbon content. The use of old locomotive tires is admirably suited to shovel manufacture, and will enable quick deliveries to be made by the mills, which otherwise would have to wait until their raw materials could be received. Having stated the advantages to be derived by the use of this metal, I will now take up the constructional details of the rolls used to reduce the tire into plate.

As the tires are of a circular section, they will have to be cut into halves before they can be used in the rolls, which can be done by sawing them either hot or cold. The method used by one rolling mill is as follows: A heavy cast-iron plate having two projecting lugs on its surface opposite each other is secured to a suitable foundation, and placed in a horizontal position with the lugs facing upwards. Fastened to the plate at a suitable distance is a hydraulic jack, so arranged that its plunger will exert pressure against the tire. The operating lever being conected to a small steam engine, the tire is placed in the frame and nicked at the sides with a cold chisel, the engine then being started. In a very short time, the tire separates into two halves, breaking at the nicked parts.

A number of them are then put into the heating furnace and heated evenly through; it being most important that there should be no cold spots on the steel, as it interferes with the proper working of the metal in the rolls. The roughing rolls depicted in Fig. 1 are three-high. This enables them to reduce the metal very quickly while it is at a white-heat.

There are different methods used to reduce the flange on the tire adopted by various mills, the designs of the rolls usually being such as is suitable to the engine power and other requirements of the plant. In the set shown in Fig. 1, the flange is rolled back into the main body of the tire; the sides of the pass having such a steep angle as to allow the bar to spread sideways in it. The heated metal is pushed by the rougher into the deepest groove in the rolls; it is then turned over before insertion into No. 2 pass. This allows any impurities in the steel, which generally comes out on the surface, in the form of scale, to drop off. The scale is loosened from the bar by small streams of water flowing on the steel while it is in the rolls. The action of the latter on the metal in the first pass also straightens the steel out in bar form, which makes the handling of it in the other passes easier. As the metal goes through each groove, it is made thinner, wider and also lengthened—these depending upon the amount of carbon and also the quality of the steel.

Locomotive tires used to be made out of crucible steel, but they are rolled out of open-hearth steel nowadays, as it has been found out by experience that the open-hearth process makes good reliable tires. After rolling, the bars being about 8-inches wide by ⅝ of an inch thick, are cut into suitable lengths, being about two feet long, and put into a heating furnace and re-heated. They are then ready for the sheet roughing rolls illustrated in Fig. 2. Each one is 36 inches long and 26 inches in diameter and made out of chilled cast iron. These rolls are turned with level surfaces. The two-foot long bar is given two passes, it being inserted crosswise, the rolls being lowered by means of the screws on top of the housings before the hot bar is run through the rolls. The cross rolling that the metal receives, makes it wider; the length being nearly the same. It is then turned at a right angle to its previous position and given one pass lengthwise through the rolls, the latter being lowered before the metal is run through them.

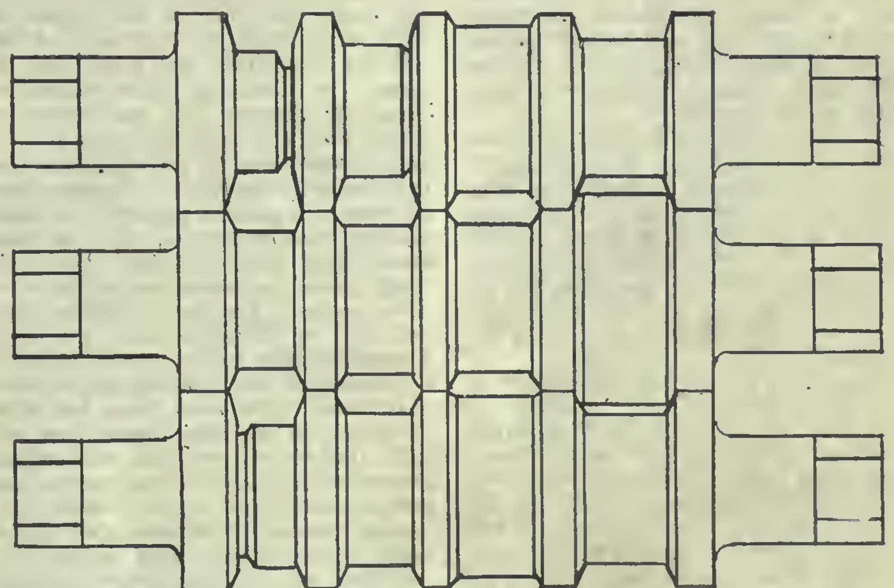


FIG. 1—Roughing rolls used for breaking down the old locomotive tires into bars, so that they can be used in the sheet roughing rolls. The violent change in section removes the crystallization of the worn tire and makes it into a fibrous nature—which is the condition that makes for strength in iron and steel.

The bar is now about ⅛ of an inch thick and is ready for the finishing rolls depicted in Fig. 3. These rolls are 22 inches in diameter by 26 inches long. As will be noted in the illustrations, one roll is turned straight, while the other has a concave surface. The amount of roll curvature shown on the drawing is purposely exaggerated, in order to make the picture clearer, the actual amount of surface curvature at its deepest part in the centre being about six one-thousandths of one inch.

It has been found out by experience that the thinner the plate rolled, the more concave the roll surface should be. This is in turn modified by such factors as the proportions of the diameters of the rolls to their body length; the gauge of plates rolled and also whether they are operated with or without streams of

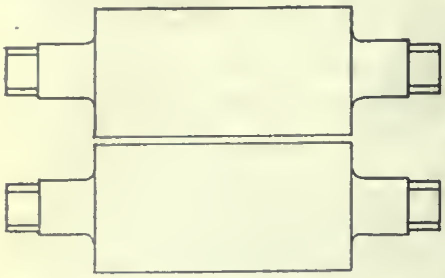


FIG. 2—Illustrates the sheet roughing rolls. the use of these rolls enables the finishing rolls to remain longer in the housings before requiring dressing. thus saving money and reducing the costs of manufacture.

water flowing upon them. The speed of rotation also has its influence on their smooth working. The reason why they require to be turned with a concave surface, is, that they expand by the heat, the centre of the rolls being actually larger in diameter than the parts at either ends of the roll body. By having sufficient curvature, they expand so that their surfaces are straight and level. If a set of sheet rolls were turned level and used to make thin sheets, the latter would buckle badly and become useless. It will be noticed in Fig. 3, that only one roll has a concave surface—the other being turned straight.

In practice, both rolls could be turned with curved surfaces; in this case, it would be necessary to divide the total depth at the deepest part of the rolls (which is the middle of them) between the two rolls. They would then possess straighter peripheries, the curves not be-so deep. By the use of rolls turned either way plates free from buckling are obtained.

From an economical standpoint it is found quicker and cheaper to turn one roll straight, and the other concave, as it would take nearly double the time to turn both rolls with a curved surface than it would require to finish one, it taking very careful and accurate turning on the roll turner's part to make them operate smoothly in the mill. Having described the reasons for curving the surfaces of the finishing rolls we will now take up the rolling of the steel to the desired gauge. The metal is transferred from the No. 2 set of rolls to the No. 3 ones. It is given three passes lengthwise, the screws being worked after each reduction until a thickness of 1-16 of an inch is reached. After each heat is over, water is turned on the No. 2 set of sheet rolls, the finishing set being worked with a continuous flow of water in small streams while they are in operation. In shovel plate manufacture, it is desirable to keep the rolls working in the housings as long as possible. As a general rule, the surface of the rolls wear hollow in the middle long before their centre surfaces get too rough to make good plates. This necessitates frequent dressing, which takes time and costs money. In order to make them last as long as possible, one company devised a rigging which attaches to the front of the housings, whereby, wooden blocks fed with emery powder are pressed against the bodies of the rolls, a short distance from each end, next to the journals. This prevented them from getting too deep in the centre. The rolls were ground every Saturday afternoon, after the day's work was done, the method proving very effective, the No. 2 set being in the housings five weeks before requiring dressing. The No. 3 or finishing set were also scoured with emery when they required it. The emery scouring method enables both sets of rolls to be kept longer in the housings than would be the case if it were not used. Rolls for making tin plates, which are very thin in gauge, are also turned concave. These rolls need more surface curvature as they expand considerably by the heat.

Tin plate rolls are usually from 24 to 26 inches in diameter, the length varying. A roll 24 inches in diameter by 32 inches length of body, should be turned 1-16 of an inch deeper in the middle (measured by a caliper) than at the ends next to the journal or necks. In other words, the depth of curvature at the lowest part of the roll, should be 1-32 of an inch on each side of the roll. If the latter are more than 26 inches in diameter, more concavity should be allowed. The temperature at which iron and steel is finished is of great importance to the appearance of the product. Too high a finishing temperature will cause a thin layer of scale, which a strain of bending will make them break away from the metal and leave rough spots, the appearance of the sheet being spoiled. Too low a finishing temperature, on the other hand, will yield a spotty-reddish surface which is prone to oxidize or rust. Sheets are finished in different styles, some being left black in color just as they come from the rolls. Others are covered with copper, aluminum, or tin—a mixture of tin and lead is also used to coat sheets for roofing purposes, which are called "terne-plates," they being used extensively. And last, but not least, large quantities of sheets are made coated with zinc which are sold under the name of galvanized sheets.

Steel sheets have replaced iron ones to a large extent. But the great increase in the use of steel is not without its drawbacks. Our galvanized iron and tin plates are no longer made of iron, but of steel, which metal is by no means as durable; nor does the coating of zinc or tin adhere so strongly as it did upon the softer and more porous iron plates which were used before the steel processes were developed. As a general rule, steel whether in the form of pipes, sheets or bars, etc., corrodes much quicker than iron when exposed to the weather. This is due, no doubt, to steel being much purer in quality than wrought iron, the impurities in the latter hindering corrosion. The method used by the roll turner to turn the proper curvature on the one roll will be interesting to the readers of this magazine, it showing the manner in which the work is done. The first thing done is to turn one roll level so that when a straightedge has chalk rubbed on the edge, the superfluous amount being blown off by the breath, and the straightedge placed carefully on the roll and rubbed lengthwise, the chalk will mark a line on the roll, touching at all places if the turning has been carefully done. The roll is then taken out of the lathe and the one to be turned with a curved surface put in the machine. The finished roll is placed in the carriage and put on top of the one in the lathe. The top roll carriage containing it is now moved 2⅝ inches to one side, (measured from the centre on the end of the roll in the lathe) and fastened in that position, the middle of the roll on top being put as close as possible to, but without touching the roll in the lathe.

The turning of it is now begun from the middle; cuts about 1½ inches wide being taken until the roll has a uniform concave surface, so that when the top roll still in its diagonal position is allowed to rest upon the bottom one, no light can be seen between them. It is then finished and ready for the mill. When newly turned rolls for making thin sheets such as tin plates are put in the mill, or are started on a Monday morning, it is necessary to bring them to their maximum temperature before wide sheets can be rolled. This is done by rolling narrow ones, until the rolls have expanded sufficiently to become level and make perfect plates.

Turning of sheet rolls is a tedious process, and attempts have been made

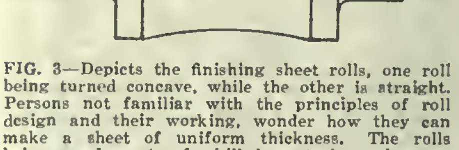


FIG. 3—Depicts the finishing sheet rolls, one roll being turned concave, while the other is straight. Persons not familiar with the principles of roll design and their working, wonder how they can make a sheet of uniform thickness. The rolls being made out of chilled cast iron, keep a smooth surface much longer than the ordinary cast iron ones. The use of chilled iron rolls for finishing sheets also saves money for the manufacturer and reduces the prices that the consumer pays.

to do this work by means of specially constructed grinding machines. This is a great success, both from an economical standpoint as well as a quality one, the work being done in one-half the time that it takes a roll turner to do it; while the rolls have a smoother finish and are more accurate in every respect. Sometimes a jam in the rolls will cause what is technically termed "a burnt spot." Its shape varies, depending upon the form of the material rolled. In sheet rolls it takes the form of a long streak of compressed chilled iron, extending parallel to the axis of the roll, its depth being about one-eighth of an inch.

Chilled cast iron is the hardest metal that the roll turner has to turn. The tool used to do the work is very little harder than the chilled iron, therefore in order to cut the metal at all, the roll has to revolve at a very slow speed, its periphery moving at a speed of one-half a revolution a minute. When a "burnt spot" is encountered, it being harder than the tool steel used to turn the roll, the edge of the tool breaks out and slides over the spot and refuses to cut. All the roll-turner can do when he discovers a burnt spot is to re-sharpen the tool, put it in the lathe and when the burnt spot nears, to take a very heavy cut so as to get under it and lift it out. When it is one-eighth of an inch deep, it has to be broken down a small amount at a time until it is finally removed. Doing this work is very tedious, and after it is done, the roll is made from ⅛ to ¼ of an inch smaller in diameter, the metal being wasted.

From the foregoing, it will be seen that it is necessary to turn a burnt spot entirely out of the roll in order to get a smooth surface, thus wasting time and money when a sheet roll is turned in the ordinary way. On the other hand, when a roll grinder is used, the emery wheels being very much harder than the metal in the roll, the burnt spot is easily ground with the rest of the roll's surface; only enough metal requiring to be removed to true and smooth up the roll.

The burnt spot being made smooth like the rest of the roll, it does not interfere with the making of good plates. Roll grinding machines are money savers and they are being used in increasing numbers. The writer knows of one mill where the rolls are necked in the usual manner, the necks being left 1-32 of an inch larger than the desired size, they being then ground to size in the roll grinder. This makes the rolls operate much better in the mill housings than when they are finished by means of a roll lathe. In conclusion, old locomotive tires can be made into other useful sections besides shovel and nail plates or for saws; the metal having such a uniform texture and excellence as to be made by the aid of rolls into quite a variety of shapes.

RENDERING CONCRETE-WEARING SURFACES NON-SLIPPING

Floor surfaces are usually rendered non-slipping by means of grooving, and many other forms of indentation, usually made by means of metal stamps or brass rollers, having studs or channels on their revolving surfaces. There are, however, occasions when these expedients are not possible, and it is then that the use of emery can be put to good advantage.

Emery is manufactured in various grades, but that known as flour emery is principally used for concrete steps and landings, while a granular form is used chiefly for gradient concrete surfaces.

It is quite unnecessary and wasteful to mix emery throughout the whole thickness of the concrete. Such surfaces are usually topped with at least one inch of granolithic concrete, through which the emery flour or coarser-grained emery is mixed. Steps, for the sake of appearance, are usually trowelled smooth; other surfaces may be left from the straightedge, although, should the occasion arise, granular emery may be sprinkled over the soft concrete surface, and slightly pressed in flush with trowel or handfloat. One pound of emery flour mixed with two parts granite, half pail of granite-sand, and one of cement, mixed thoroughly in the dry state before wetting, will, in an ordinary case, be successful.—M. E.

ANTI-FRICTION AND OTHER ALLOYS

At the meeting of the Allied Metals Congress held at Milwaukee October 7-12, a very practical paper was presented by Mr. H. M. Warring, Altoona, Pa., on the subject of the anti-friction and other alloys that have been adopted by the Pennsylvania Railroad and outlined some of the methods evolved by this company to hold their tin consumption to a minimum. The approximate composition of the non-ferrous alloys in general use by this railroad follows:

	Copper	Tin	Lead	Zinc	Antimony	Phos.
Phosphorus bronze	79.70	10.00	9.50	....	....	0.80
Ex. b. bronze	76.75	8.00	15.00	....	....	0.25
Car journal bronze	75.00	5.00	16.00	3.00	....	1.00
Special high-lead bronze	70.00	5.00	25.00	....	....	....
Lining metal	.....	....	.....	....	13.00	....
Dandelion metal	.....	10.00	72.00	....	18.00	....
Bell metal	83.33	16.67	.....	....	....	....
Babbit tin-base ..	3.70	88.90	.....	....	7.40	....
Babbit for motor bearings	1.00	50.00	38.50	....	10.50	....

Phosphor bronze is used principally for rod bushings, main rod brasses and cross-head shoes.

Ex. B. Bronze is used to a small extent for backs of car and coach bearings, but the majority of these are now made of car journal bronze which contains on the average about 5 per cent. of tin.

Car journal bronze is used for making car and coach bearing backs, by melting down the old backs after removing the linings and making the necessary addition of new metal to bring the composition within the limits given above. No new tin is added in making this alloy.

Formerly the lead-base linings of car bearings was melted off and brought up to requirements by additions of new metal as required, but lately as this metal contains some tin, it has been used in making dandelion metal, thereby conserving the tin content. The lining metal is then made from new lead and antimony and contains no tin. Dandelion metal contains about 10 per cent. tin and is ued for lining cross-head shoes, engine truck and trailer bearings, hub liners and so forth, and its use has eliminated a large amount of tin-base babbitt.

Bell metal is used for locomotive bells, and during 1917 about 21 tons of this type of casting were made, involving the use of slightly above three and a half tons of tin.

The use of tin-base babbitt has been greatly restricted and every effort is being made to replace it with lead-base babbitt.

The amount of solder containing 50% tin and 50% lead was a big item, but the bulk of this has been changed to 40% tin and 60% lead, making a considerable saving in tin.

Another practical paper was presented by M. L. Lissberger on the subject of tin economy in solders. The method adopted by his firm in making solders is to first melt the lead, then add a flux and skim the dross, after which the tin is added. After this addition the bath of molten metal is stirred continuously for from five to six hours to thoroughly incorporate the metals, because if this is not done, trouble from segregation will ensue owing to the fact that tin and lead do not form alloys, but exist together as a mechanical mixture. It is therefore necessary to thoroughly break up the droplets of metal to enable those of the two metals to come into intimate contact and thus produce a more homogeneous mixture than is otherwise possible This segregation is illustrated by what occurs when a block of solder one inch square and six inches high is cast. An analysis taken from the bottom will show 47 per cent. tin and 53 per cent. lead, and from the top 53 per cent. tin and 47 per cent. lead, when the metals have been thoroughly mixed. This illustrates why so much more tin than lead is lost in making solders by drossing. The alloy from which the above example is taken is composed of 50 per cent. tin and 50 per cent. lead. For solders used as a filling metal and not as a cement, tin can be conserved by using an alloy of 20 per cent. tin and 80 per cent. lead. For adhesive purposes and especially for food containers, a solder containing 40 per cent. tin and 60 per cent. lead can be recommended. For making solders, overheating must be avoided with the utmost care, otherwise much tin will be lost on account of the excessive dross that will be formed, and as this dross is always richer in tin than in lead, it will be evident that the alloy itself is impoverished in tin, and much of this metal is wasted unnecessarily.

An excellent solder consists of in 46 per cent. and lead 54 per cent., with a small amount of antimony, say about 0.25 per cent., which improves its appearance.

A storage battery electric locomotive, invented in Switzerland, for switching, uses powerful electromagnets instead of couplings for drawing cars.

Testing Machines in Industrial Laboratories—II

The Wise Purchasing of Engineering Materials is Dependent Upon Specifications Properly Controlled by Analysis and Test

By H. S. PRIMROSE, Messrs. Crittal Mfg. Co.
and J. S. GLEN PRIMROSE, Messrs. Ransomes & Napier, Ltd.

THE various forms of impact and pressure machines for determining the values of hardness of metals are now well known, and serve the useful purpose of being able to connect by a simple factor the hardness value with a close approximation to the tensile strength of the material. Table III gives a useful list of equations connecting the tensile strength in tons per square inch of various steels, both alloy and plain carbon, with their hardness on the Brinell and the Shore scleroscope scales, as also the relation which exists between these two scales for the steels concerned.

TABLE III—Equations connecting the Tensile Strength in Tons per Square Inch with the Hardness of various Steels on the Brinell and Scleroscope Scales, also the two Scales with one another.

Steel.	T.S. from Brinell No. "B."	T.S. from Scleroscope, Value, "S."	Brinell No. from Scleroscope.
Carbon	0.325B—12.5	1.96S—12.5	5.6S+0.14
Nickel	0.318B—14.3	1.56S— 2.7	5.0S+0.48
Chrome-Vanadium	0.318B—12.9	1.87S— 9.4	5.5S+0.27
Low Chrome Nickel	0.304B— 9.8	1.65S— 0.45	5.4S+0.33
High Chrome Nickel	0.318B—14.7	1.05S— 1.34	4.8S+0.58
Average	0.312B—11.6	1.80S— 6.7	5.5S+0.28

One method of performing the Brinell test is by the insertion of a special carrier in the crown of the Amsler testing machine and bringing up the pressure to the required amount on the test-piece, measuring its value on the dial scale (Fig. 8). The diameter of the impression may be read with sufficient accuracy by means of a transparent taper scale, and the corresponding hardness value in kilogrammes per square millimetre may be derived from a graph made on logarithmically-squared paper to save the use of long tables of figures.

Instead of the diameter, the size of which is sometimes doubtful in the case of soft metals, it is often preferable to measure the depth of the Brinell ball imprint to get the area of the cavity in terms of the product 3.1416 D t, where D is the ball diameter and t the impression depth, both in millimetres. Messrs. Amsler Brothers have a very neat form of depth indicator which may be inserted in their compression machine in the same way as the ordinary bolster carrying the plain ball. In this case the ball is held in a somewhat longer chuck, which passes through te body of the depth-measuring instrument made of bronze and provided with a collar carryiny a very fine screw thread on the outside, and engaging the ball chuck by friction. The outer body of the instrument bearing the scale graduated n twentieths of a millimetre supports a ball-and-socket ring loosely held by three screws, and any motion of the ball chuck relative to the frame pushes open a retaining spring, lowers the finelv-threaded screw collar, and rotates a pointer over the graduated scale. The method of operation is exceedingly simple, and the zero adjustment can be quickly and accurately performed. The smooth metal surface of the specimen to be tested is raised by the support in the cradle until it engages the 10 mm. steel ball, then the body of the instrument is slipped down on the chuck till the ring rests on the test-piece. By pulling out the disengaging handle to the left, the pointer swings loose, and can be brought near to the zero mark before again engaging the screw. If the pointer still misses the zero mark, the milled head of the screw can be rotated slightly to make the coincidence exact. The desired load is next applied, and the ball, entering the metal under pressure, carries the pointer over the scale to a point indicating the depth of penetration. Elastic deformation must be allowed for by releasing the load to all but about 20 lb., and then reading the correct depth. The construction of this compact instrument is shown in the diagram, Fig. 8.

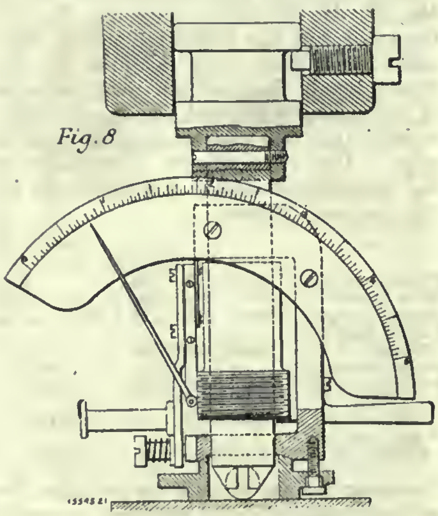


FIG. 8

A more recent form of the same type of depth indicator made by the firm of Amsler Brothers is shown in Fig. 9, which illustrates the application of the same principle in the determination of hardness by means of the 90 deg. angle Ludwik cone. The knurled ring surrounding the cone rests with it at the same level on the smooth surface of the test specimen. When the cone, under pressure, enters the metal, the knurled ring remains on the surface and pushes back the outer frame of the instrument and thus rotates the pointer over the scale, each division of which represents a depth of penetration of one-hundredth of a millimetre.

Guillery Hardness Testing Machine

A very useful form of portable hardness-testing machine, the results from which can be arrived at without any measurement or calculation, is that designed by R. Guillery and made by Messrs. Malicet and Blin, of Aubervilliers, France. The simplicity of construction is readily seen from the illustrations of the machine given in Figs. 10 and 11. The iron frame A contains in its lower part a powerful spring R which is made up of a number of discs forming a Belleville spring. This is accurately standardized to give a pressure of 3,000 kg. to a plate Q carried on the central rod B passing through the spring, and this rod rests on the knife edge C. The forward movement of the hand lever G causes the cam to raise the bent lever D about its fulcrum and apply the load. The milled head I serves to rotate the screw V bv friction, but this slips round immediately the hardened steel ball H, clipped securely to the screw, comes into intimate contact with the test-piece placed on the supporting plate Q. The semi-circular scale M is attached to the upper part of the frame, and the pointer L is carried by slight friction on the plate J, which rotates with the screw V. In working the machine, the hand lever is first put back into the rear position, and the test-piece is lightly gripped between the ball and the supporting plate by advancing the screw by means of the milled head until slipping takes place and the screw ceases to move. Then the pointer is brought over the zero mark of the scale. the hand lever is brought forward to the front position, where it remains without being held for the required time, and it is then put back into its first position. In this way the ball comes out of the impression it has made and the screw is again free to advance and engage the surface of the metal in the indentation. The driving head I is therefore rotated until the screw goes no further and slipping occurs. This operation carries the pointer over the graduated scale to the same angle that the screw has turned, and for soft metals this operation of applying the pressure and advancing the screw is repeated till the screw will advance no further. This then measures the depth of the imprint, but the graduations on the scale are so arranged that it is not the actual depth which it indicated, but the corresponding Brinell hardness number. The sole precaution needed is to ensure that intimate metallic contact exists between the ball and the test-piece, since any scale will spoil the correctness of the reading, which is ordinarily quite sufficiently accurate for commercial purposes. The hardness value can always be checked by measuring the diameter of the imprint in the usual way. A large size of this type of hardness tester has recently been brought out by Guillery, but as it works in the horizontal direction it readily enables the largest shells to be tested for hardness in any side position across a diameter. A sectional view of this machine is given in Fig. 12.

Impact-Testing Machines

The importance of the impact test is gradually coming to be more widely recognized, and a valuable impulse to its adoption has been given by the latest results of the Committee of the International Association for Testing Materials, which were published recently by Charpy. He tested several different types of machine, which, although working on such different principles as the drop-weight, the swinging pendulum, and the rotating flywheel, yet were found to give strictly comparable results, and these were found to be quite independent of the weight and speed of the tup used, and also of the weight of anvil used, provided, of course, that the steel used is thoroughly normalized, and that the method of holding the test specimen was not objectionable, but merely resting in its place.

The swinging pendulum type approved by the International Association is well known, but the Amsler vertical drop-weight machine mentioned by Charpy is less well known, and has recently been superseded by a new form of swinging hammer. This is shown in side view in Fig. 13, and consists of a heavy cast-iron base to which are bolted two upright channels supporting the pendulum and the elevating winch which can raise the pendulum either to left or right, depending upon how the detachable hook is attached. On falling from the left side the weight breaks the test-piece transversely and when falling from the right, tensile impact tests are made. A friction clutch holds the swinging arm in any desired position as the windlass raises the bob weight, and the operating handle cannot be moved by the weight itself, but only by the operator. On pulling the release cord, the hook is detached and the trip falls freely, and after breaking the bar it swings up on the other side of the machine. Instead of swinging back, however, it is held in its position of maximum height by a third cord passing round a drum and acting as a brake. The circular weight at the end of this cord exerts a sufficient pull to prevent the pendulum from falling back from any position until it is released. To measure the energy absorbed by a blow of the pendulum the difference is noted between the readings of two scales provided on the vertical supports. The elevation of the weight moves a pointer over the first scale to show the energy stored before the blow, and the swing of the pendulum carries another pointer over a second scale to indicate the residual amount of energy after the blow. The change over from transverse impact to tensile impact test is readily accomplished by unhooking the elevating cord from one side of the tup and fixing it to the other side, then the windlass is

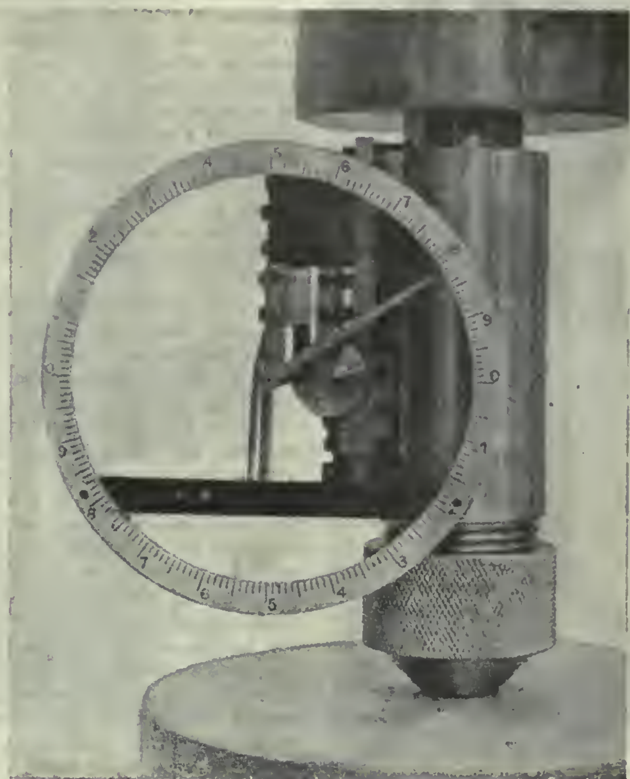
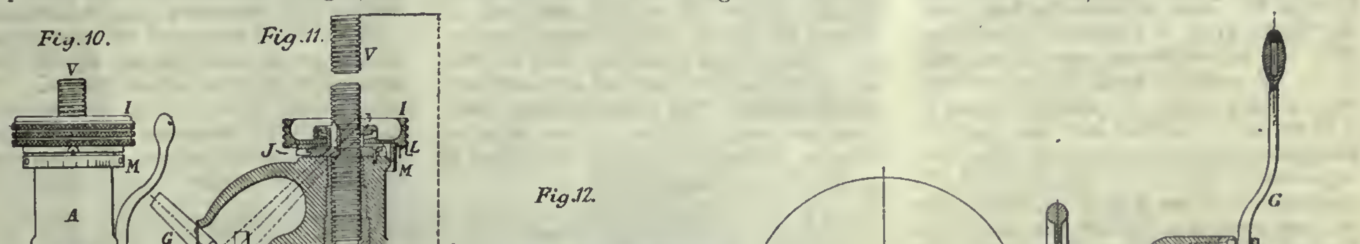


FIG. 9—MACHINE FOR DETERMINING HARDNESS BY 90 DEG. LUDWICK CONE.



FIGS. 10 TO 12—GUILLERY HARDNESS TESTING MACHINES

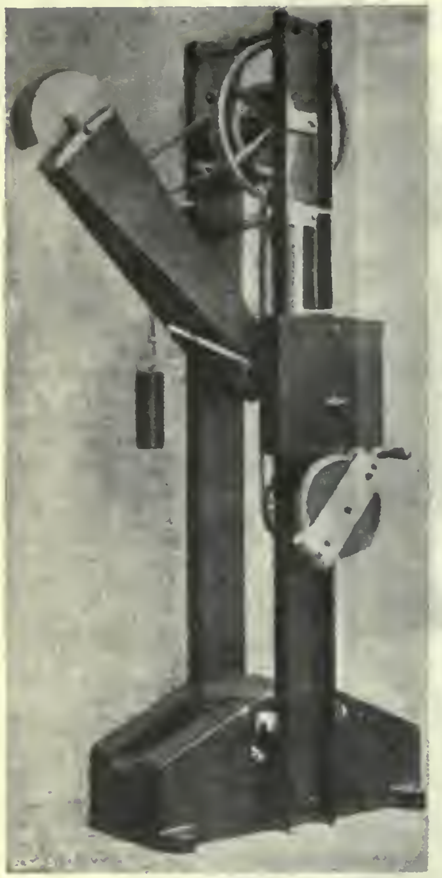


FIG. 13—AMSLER SWINGING-HAMMER

wound up by turning the handle in the opposite direction from before.

Guillery Impact-Testing Machines

The most convenient type of impact tester for works practice which entails the minimum of effort and calculation, is the rotary dynamometer tup or rotating flywheel made by Malicet and Blin to the design of M. Guillery. The latest form of this machine consists of a flywheel of such shape and size that when rotating at 302 r.p.m. the velocity of the striking knife is the same as that of a body falling freely from a height of 4 m. (say 29 ft. per second). The moment of inertia of the wheel is such that when hunning at this speed, the energy stored in it is 60 m.-kg. for the one size, and 275 m.-kg. for the heavier type of wheel approximately 440 ft.-lb. and 2,000 ft.-lb. respectively. The lighter machine may be compared to a falling tup or "monkey" of 15 kg. weight falling from various heights up to 4 m., and these are registered by one of the speedometer scales. It is usual to work up to the highest reading and capacity of the machine, and for this reason the scale for measuring the energy absorbed in the blow has its zero at the top of the tube. The flywheel of the machine is made to rotate by a handle connected with an adjacent lever which, according to its position either puts the handle into gear for speeding up, or disengages to allow the wheel to run free. A third position applies a brake to stop the rotation of the wheel when the tests are completed. The connection between handle and wheel can be made readily when the wheel is in motion. An ingenious device throws the handle out of gear if it is attempted to turn the wheel in the wrong direction. The equivalent height of drop and the energy absorbed by the impact are read on the tachometer tube, the scale of which gives the highest reading when the wheel is at rest and adjusted to coincide with the 60 m.-kg. mark by means of a milled screw. This moves up or down a float inside the centrifugal pump shown in Figs. 14 and 15, and the vanes of this (rotated by bevel wheel from the axis of the flywheel) serve to raise a colored liquid in the speedometer tube.

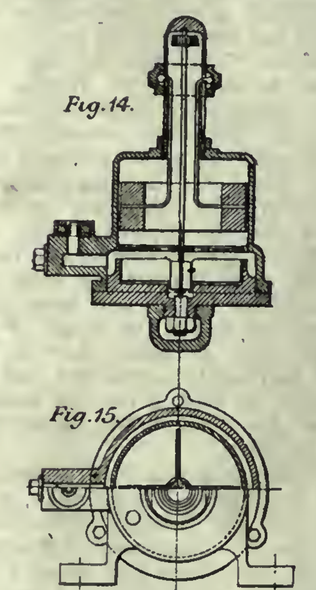
A view of the machine taken with the cast-iron top cover removed from the lower casing and pedestal, shows in Fig. 16 the simple mechanism whereby the breaking knife is attached to the flywheel, so that when in the closed, or "in" position, the knife is completely encased within the rim of the flywheel. When the red stud is pressed, the spring forces the knife into the open or "out" position required for breaking the test bar. The knife is made to assume these positions by means of the rotation of the flywheel itself, according as the closing or opening button is pressed on the outside of the lower casing. In working the machine, it is only necessary to restore the energy lost in each test to make the machine ready for the next test. The danger of the open knife is obviated by a simple device which prevents the door (enclosing the test bar when in position) from being opened so long as the knife is out and the flywheel still rotating. The small and safe design of this machine, in which all the moving parts are enclosed, the lack of overhang and stability even without bolting down, so long as it rests on a level floor, and the direct reading of the energy absorbed, makes this machine one of the most simple and advantageous to use.

Table IV gives the results of several samples of mild steel which had proved brittle in working and which gave low impact values. A replace material, although similar in other physical properties behaved well in service, and, on testing in the impact machine, showed much better results. The effect of heat treatment on some medium carbon steel as regards impact values is also shown in an interesting fashion.

Repeated Impact-Testing Machines

One of the simplest forms of repeated impact-testing machines recently introduced, to avoid the chattering sometimes met with, is the Eden-Foster machine, which is made in this country. A cam operates a lifting chain to engage a small vertical drop hammer, which is only released when the lifting mechanism is lowered to be clear of the fall. Two different weights of tup are used, and the whole apparatus is small and compact, although capable of taking the standard notched bar for this test. The bar is rotated in a simple friction clutch method whilst securely held in two plummer blocks.

A different principle is used in the quadruple hammer machine for repeated shock testing, as made by Messrs. Amsler Brothers. The bar to be tested is supported at the two ends, and a pair



FIGS. 14 AND 15—PUMP FOR GUILLERY MACHINE

of hammers deal it blows alternately from right and left until it breaks. The fracture is thus produced by fatigue. At the moment of fracture of the bar, the mechanism actuating the hammers is thrown out of gear and the blows cease. A counter indicates the number of blows received by the bar before fracture. The machine as shown in Fig. 17 consists of four pairs of hammers working simultaneously upon four bars. The hammers receive their motion from a single shaft.

TABLE IV—Physical Tests of various Steels showing Tensile and Hardness Tests correlated with the Resistance to Shock represented both in Metre-Kilogrammes per Centimetre and in Foot-Pounds per Square Inch.

Steel.	Tested.	E.L. Tons per Sq. In.	T.S. Tons per Sq. In.	E. on 2 In. Per Cent.	R.A. Per Cent.	Brinell Hardness	Impact Values. M.K.G.	Impact Values. Ft.-Lb.
Mild C 0.15	Long.	14.4	23.6	41.6	67.3	100	8 0	373
"	Trans.	12.6	23.8	19.5	60.5	105	5.0	233
Mild C 0.18	Long.	15.0	29.0	33.2	51.8	115	12.6	580
"	Trans.	14.4	28.0	26.3	35.0	110	15.0	700
"	Lon.	18.2	26.3	51.0	53.0	110	27.0	1,260
Mild C 0.2	Normal	12.4	21.8	10.0	9.0	105	8.2	380
"	Forged	22.8	33.6	16.8	20.6	150	9.5	445
"	Toughened	25.2	34.4	27.9	40.9	145	15.5	725
Med. C 0.84	Normal	20.2	33.5	28.0	48.0	122	10.0	467
"	Oil quenched	40.0	52.2	15.0	54.0	230	19.0	890
"	Double oil qu'ched	28.5	43.7	26.0	62.0	180	27.0	1,260

driven by a small electric motor. The pairs of hammers are quite independent of each other, and when one pair stops owing to the fracture of the bar, the other pairs continue their movement, so that the different bars are tested quite independently. The bars are cylindrical independently. The bars are cylindrical in shape, and 12 mm. in diameter, from 18 cm. to 19 c.m. long, as their supports are 17 mm. apart. These supports can turn on a vertical axis, which permits the bars to be bent freely by each blow, so that they do not behave like tightly-gripped bars. The blow of the hammers is delivered at two diametrically opposite points. The weight of each hammer is 5 kg., and they fall freely through a vertical height of 5 cm., so that each blow expends ¼ m.-kg. of energy on the bar. The counters record the number of rotations of the shaft, and thus the pairs of blows struck. The usual speed of rotation is about 90 r.p.m.

FIG. 16—GUILLERY IMPACT-TESTING MACHINE

BRITISH ADMIRALTY APPRECIATES MERCHANT SERVICE

On the occasion of the first meeting of the Board of Admiralty after the signing of the German armistice their Lordships desire, on behalf of the Royal Navy, to express their admiration and thanks to the owners, masters, officers, and crews of the British Mercantile Marine, and to those engaged in the fishing industry, for the incomparable services which they have rendered during the war, making possible and complete the victory which is now being celebrated.

The work of the Mercantile Marine has been inseparably connected with that of the Royal Navy, and without the loyal co-operation of the former the enemy's submarine campaign must inevitably have achieved its object. The Mercantile Marine from the beginning met this unprecedented form of warfare with indomitable courage, magnificent endurance, and a total disregard of danger and death, factors which the enemy had failed to take into account and which went far towards defeating his object.

In no small measure also has the success achieved against the submarine been due to the interest taken by owners in the defensive equipment of their ships, and to the ability, loyalty, and technical skill displayed by masters and officers in carrying out Admiralty regulations, which, though tending to the safety of the vessels from submarine risks, enormously increased the strain and anxiety of navigation. The loyal observance of these precautions has been the morec ommendable since the need for absolute secrecy, on which safety largely depended, has prevented the reasons for their adoption being in all cases disclosed.

Further, the convoy system, which has played such an important part in frustrating the designs of the enemy and securing the safe passage of the United States Army, could never have attained its success but for the ability and endurance displayed by the masters, officers, and crews of the merchant ships forming these convoys. This system has called for the learning and practising of a new science—that of station-keeping, the accuracy of which has depended in no small measure on the adaptability and skill of the engineers and their departments.

Their Lordships also desire to acknowledge the ready response of owners to the heavy calls made on the Merchant Service for officers and men to meet the increasing requirements of the Navy. On board our ships of every type, from the largest dreadnought down to the smallest patrol boat, are to be found officers and men of the Merchant Navy, who have combined with those of the Royal Navy in fighting the enemy and defeating his nefarious methods of warfare at sea.

The Merchant Service and the Royal Navy have never been so closely brought together as during this war. In the interests of our glorious Empire this conclusion must prove a lasting one.

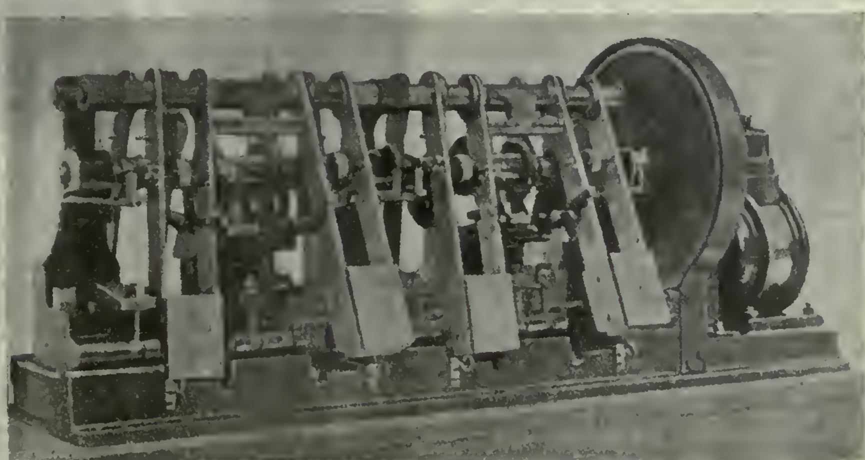


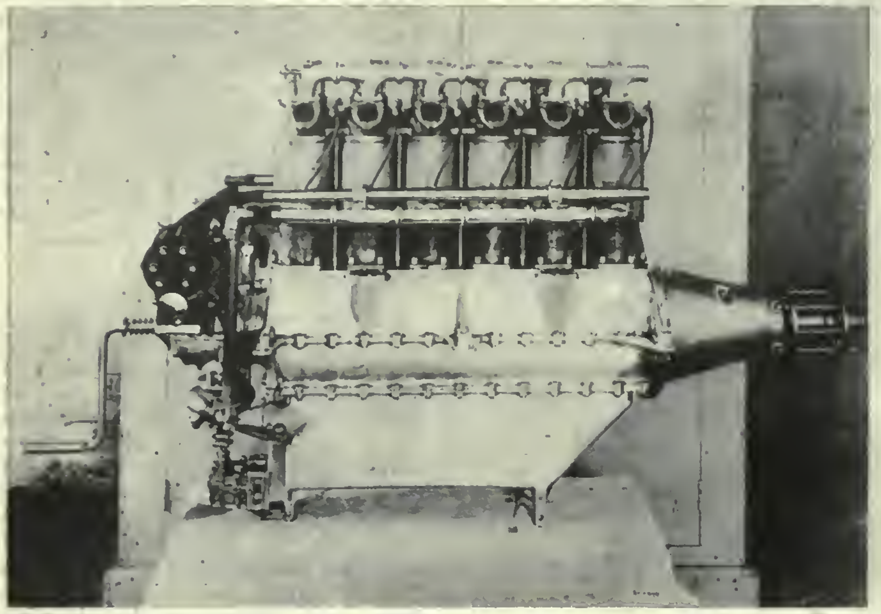
FIG. 17—AMSLER QUADRUPLE-HAMMER MACHINE FOR REPEATED SHOCK TESTING

The Greenfield Tap and Die Corporation, Greenfield, Mass., have issued catalogue 40 on small tools. As its name indicates, the tools featured are taps, dies, screw plates, reamers, and other tools of like nature. The screw plate section describes all the various plates made by the firm for every purpose, including automobile and metric sizes. Hand taps are described in detail, the gun tap being particularly worthy of mention. Nut taps, tapper taps, pulley taps, and other kinds are described at some length. The reamer section contains information concerning the various lines of reamers manufactured by the corporation, and the data section contains much material of value bearing on threads and thread cutting. Much of this is new and has to do with the gauging of threads.

AEROMARINE 6-CYLINDER VERTICAL MOTOR

By F.C.P.

The accompanying illustration shows a novel aeromarine 6-cylinder vertical motor of which the reciprocating and revolving parts are made of steel and the upper and lower parts of crank case are made of composition aluminum casting.



AMERICAN SIX-CYLINDER AEROPLANE MOTOR

The oil reservoir in the lower half casting provides sufficient oil capacity for five hours continuous running at full power and increased capacity is provided to meet greater endurance requirements.

As to the oiling system it may be stated that the oil is forced under pressure to all bearings by means of high pressure duplex geared pumps. One side of this pump delivers oil under pressure to all the bearings while the other side draws the oil from the splash case and delivers it to the main sump. The oil reservoir is entirely separate from the crank case chamber. Under no circumstances will oil flood the cylinder and the oiling system is not affected in any way by any angle of flight or position of motor. An oil pressure gauge is placed on instrument board of machine which gives at all times the pressure in oil system and a sight glass at lower half of case indicates the amount of oil contained. It is held that the old style system of dropping lower half of crank case to clean strainers and inspect pumps is avoided and the oil pump is external on magneto end of motor and is very accessible. There is provided an external oil strainer which is removable in a few minutes' time without the loss of any oil. All oil from reservoir to the motor passes through this strainer. Pressure gauge feed is also attached and can be piped to part of machine desired.

The water jackets are of copper 1/16" thick electrically deposited. This makes a non-corrosive metal. The cooling is furnished by a centrifugal pump which delivers 25 gallons per minute 1400 R.P.M. The pistons are made cast iron, accurately machined and ground to exact dimensions, which are carefully balanced.

The intake manifold for carburetors are aluminum castings so designed that each carburetor feeds three cylinders thereby insuring easy flow of vapor at all speeds. The power developed is 85-90 h.p. and the weight of the motor is four hundred and twenty pounds. The data of a horsepower test on one of these 6-cylinder motors as given in the following for an engine with 4 5/16" bore x 5⅛" stroke may be of interst:

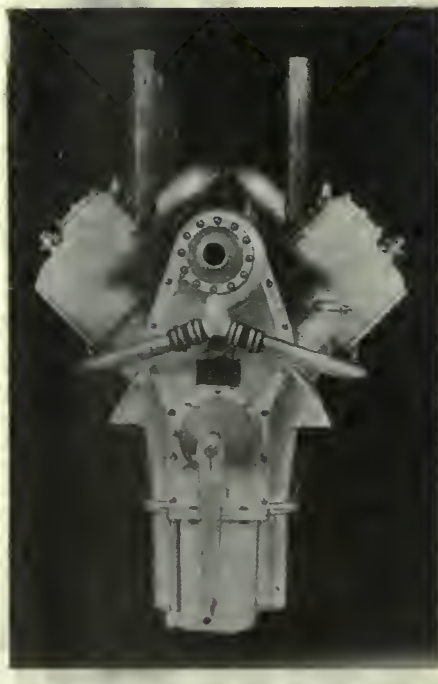
Fan-blade	Revs. per min.	Pull in lbs.	h.p.
D	1830	52.	95.16
C	1700	56.5	96.0
B	1510	58.5	88.33
A	1350	62.	83.7
0	1140	62.	70.68
00	1040	60.	62.4
000	960	57.	54.7

The average gasoline consumption for the aeromarine motor is 53.96 lbs. per hour and 8.55 gals. per hour are used which makes 0.63 lbs. or .104 gals. per h.p. hour. The average oil consumption of this engine is 1.75 gals. oil used per hour or .02 gals. oil per h.p. hour, which figures out 12.3 lbs. per hour and .144 lbs. per h.p. hour.

TUNGSTEN FILAMENTS

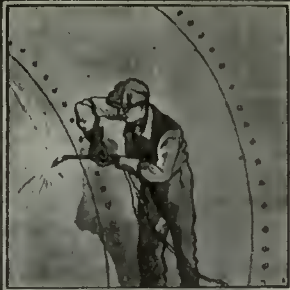
A new lamp filament patented in Germany recently consists of a single long crystal of tungsten instead of the usual irregular string of crystals and has in consequence greatly increased strength and durability. The ordinary filament is produced either by hammering fine tungsten powder into lumps, and drawing or rolling, or by squirting a mixture of the powder with a binding material and then sintering. In the new process very finely divided tungsten acid is freed from its oxygen by heating in an atmosphere of hydrogen; the powdered metal so produced is mixed with a definite quantity of therium oxide and a small amount of a colloidal binder; the paste is squirted under pressure through fine dies; and the filaments, after gentle drying, are finally passed through a forming or structure changing apparatus. This apparatus is a glass cylinder, closed and air-tight at top and bottom, containing a spiral of several turns of tungsten wire heated by electric current. In a stream of reducing gas eight filaments at a time are passed at the rate of about 8 ft. an hour, and the sudden and continued heating to 2,600° or 2,700° C., has the effect, as shown by the microscope, of joining the large number of crystals of each filament into one long crystal. In tests of 1,200 hours the filaments have shown no change, retaining great strength and freedom from cracks on bending, with no blackening of the lamp bulbs.—M. M.

W. F. Keckeisen, formerly advertising manager of the International Filter Co., and previously associated with the Federal Sign Co., has joined the staff of Russell T. Gray, advertising engineer, Chicago.



END VIEW OF ENGINE

Opening Branch:—The Independent Pneumatic Tool Company announces the opening of a Branch Office and Service Station in Cleveland, Ohio, on December 15th. A complete line of Thor Pneumatic and Electric Tools and Repair Parts will be carried in stock at 1103 Citizens Building, under the management of Mr. Hayden F. White, who has represented the company in Detroit, Chicago and Milwaukee districts for some years past.



WELDING AND CUTTING

The Steel Ship and Oxy-Acetylene Welding

The Author, in "International Marine Engineering," Makes Some Valuable Observations on the Behavior of Metals Under the Welding Flame, and the Precautions to be Observed

By J. F. SPRINGER

THE present necessity to construct quickly a vast total of tonnage has doubtless been the chief thing that has brought the newer methods of welding so prominently to the attention of shipbuilders and the Government. The oxy-acetylene process has been winning its way steadily for the past decade, particularly in connection with steel plates. I direct attention to steel cylinders used in the transportation of gases under pressure and to steel barrels employed as containers liable to rough handling. The welding work here is analogous to that required in a ship's side.

However, not all operators of the torch understand what happens to the steel and what are the possibilities of restoring any damage to the quality incident upon the application of gas and electric welding. A good many are probably ignorant that there is any damage to quality that needs rectification. Let us then consider this matter.

Behaviour of Steel When Heated

All normal, unhardened steel consists of crystals or grains built up of alternate laminations of cementite (Fe.3C) and iron, with or without separating films either of iron or of cementite. In steels containing less than 0.85 or 0.90 per cent of carbon—such as are practically all steels used for ship plates—there is a honeycomb of pure iron. The spaces or cells in the honeycomb are occupied by crystals, or grains of interleaved layers of iron and cementite. Steels containing a higher carbon percentage—tool steels—have a honeycomb of cementite; the crystals are the same as before. For steel at the dividing percentage, there is no honeycomb; the crystals are the same, but they are now in actual contact. The interleaved layers of pure iron and cementite constitute a material (it is not a chemical combination, being non-homogeneous), which has been named pearlite by Professor Henry M. Howe, of Columbia University. For ship construction, steel having the first type of structure—a honeycomb of pure iron filled with pearlite crystals—is used.

Behaviour of Crystals During Heating

The importance of this information in connection with oxy-acetylene welding centers on the behaviour of the crystals of pearlite during a rise of temperature. As the temperature rises from the normal, everyday point, nothing of importance occurs until the steel has passed above a black heat. About medium cherry red (1,274 degrees Fahr.), the grains begin to grow. As the temperature goes on up, the grain size continues to increase. Probably there is no substantial cessation of growth until the steel is at or near the melting point. If the heating is halted at any point of temperature, the growth will also halt. When the steel is cooled, whether suddenly or slowly, the enlarged grain size will still persist. Now all of this is not merely something interesting, but important practically, for the reason that cold steel with big grains is steel in an inferior condition. Its tensile strength is less than normal. Further, we are to accept it as a fact that the bigger the grains the weaker the steel. As cooling off does not restore the normal, small size and high strength, it will be readily understood why oxy-acetylene welding and similar processes (inclusive of blacksmith welding) necessarily injure the steel. These processes must use high temperatures. It is not in the gas processes, merely, that the working flame is at a very high temperature; the work itself becomes highly heated, the temperature ranging from at or near the melting point to lower temperatures as one recedes from the beveled edges and away from the groove. In the groove, every particle of the new metal has been actually melted. Of course, there has been great enlargement of the grain size. The metal must be regarded as greatly inferior in strength to the same metal when in normal condition. This applies to the new metal in the groove, to the sides of the groove and to the metal back from the groove. Every spot where the temperature has risen above medium cherry red must be viewed as damaged in strength.

Protection Against Oxidation

This is not a question of the burnt metal. Burnt steel is afflicted with a different disease. When steel is actually burnt, the carbon has been consumed. It is the procedure of burning steel that is employed in cutting with a high-pressure oxygen jet. By this process an oxy-acetylene or other heating jet is used to heat up the metal and the oxygen jet follows it very closely. The oxygen attacks the carbon and burns it. The welding operation with the oxy-acetylene flame may, however, be very well protected against oxidation. Considering the fact that oxidation might result from the oxygen passing through the torch, a proper adjustment of the flame to a neutral condition should cover the matter pretty fairly. Nevertheless, it is quite customary with many welders to use some very pure iron for the new metal. As this iron contains little or no carbon, it is but little subject to burning. In so far as oxidation from the atmosphere is concerned, the torch may generally be managed so as to utilize the large flame, which envelops the little working flame, as a protection. It is, from its very nature, a reducing flame and consequently adapted to this purpose.

Account of a Curative Procedure

In seeking to use the oxy-acetylene procedure in welding ships' plates, it is probable that a damage from oxidation could be provided against with a good deal of success by methods such as those just indicated. With this damage eliminated, however, we would still have the deterioration attendant upon the enlargement of the grain size. If the welding of ships' seams is to be a success, this deterioration must either be cured or offset. Piling up the new metal is a method of offsetting. I now proceed to give some account of a curative procedure.

If steel that has had its grains enlarged by overheating be cooled off to any point distinctly below medium cherry red (1,274 degrees Fahr.) and then reheated, its grains will begin to break up and assume a smaller size at a point of temperature at or a trifle above medium cherry red. This is understood to be a pretty well ascertained scientific fact. If the steel contains about 0.85 or 0.90 per cent. of carbon and, consequently, no honeycomb either of pure iron or of cementite, then this method is understood to yield very perfect results. Indeed, down to 0.50 or 0.40 per cent. carbon steel, the method is to be regarded as quite good indeed. The stopping point on reheating, however, rises somewhat above medium cherry red. Below 0.40 per cent. carbon steel the method is less perfect, because a compromise has to be made between carrying the heat up a bit and having a resizing of the grains that is less than complete. There is, then, a known procedure for the restoration of the quality of the steel. This method, as indicated, requires that the work be reheated after the welding is completed.

A second curative procedure may be mentioned, though it is perhaps not so successful in the generality of cases. It has long been known that working steel under the blacksmith's hammer has a beneficial effect. It did not require the new developments in connection with the microscopic study of steel to reveal this broad fact. What has been uncovered of late years is a more precise knowledge of the proper "stopping points." Probably, steel that is going to be thoroughly worked may be subjected to working at pretty high temperatures, provided the "stopping point" is well chosen and the working is continuous from start to finish. The grain size will then be somewhat larger than that which corresponds to the stopping temperature. In short, the hammer or other device will break up the grains; but the prevailing temperature is also getting in its work.

Professor Bradley Stoughton Quoted

Oxy-acetylene welders have sought to get the benefit of working by using the hammer on the weld. Probably it does some good, provided the hammering is not continued until too cool a point is reached. Let me quote from Professor Bradley Stoughton.

"Mechanical work will multiply the strength of steel from two to five times. In order to accomplish as much as this latter, however, it is necessary (1) to reduce the material to very small sizes in order that the beneficial effect of the kneading action may extend throughout the mass, and (2) to finish the work cold, in order that the metal may have no opportunity to re-crystallize. The ductility also will be increased at first by working, but again decreases if the metal is worked cold. The increase in strength and ductility is due (1) to decreasing the size of the crystals and closing the grain of the steel; . . . (3) to increasing the cohesion and adhesion of the crystals. All these effects increase the specific gravity and hardness of the metal, and are more effective in these respects, as well as in increasing strength, if hot work is followed by cold work."

Restoration of Lost Strength

It is doubtful whether in the oxy-acetylene process full compliance can ever be given to the above requirement for a thorough kneading throughout the mass. Consider a longitudinal seam between two plates in a ship's side. Since the plates have been rolled in the process of manufacture their normal strength presumably includes a decided advance on the strength of unworked steel. In fact, the high strength of the rolled plate was undoubtedly figured on in designing the ship. The process of autogenous welding materially decreases this strength because it undoes about everything that the rolling had previously accomplished. We seek to restore the lost strength by the use of the hammer. It would seem to be difficult, if not impossible, to reproduce with the hammer the condition which the rolling mill originally produced. Still, many difficult problems have been solved—this may be the next. Some mechanical device may be devised to work the metal in, and along the seam to an extent equivalent to that accomplished with the rolling mill—some device which will secure penetration of its effects and will cover all regions involved in the high heat. Such an advance in the development of the oxy-acetylene process would not be anything very radical, since machine welding and cutting have both been done for quite a number of years. Wherever a machine can be used either for welding or cutting, better work can probably be done as mechanical methods automatically secure evenness and regularity. Long straight seams, such as those on a ship's side, are particularly well suited to machine welding methods. It would seem, then, that a machine forger or kneader might very well handle this same class of work. Several years ago the present writer gave an account of European machines for the welding up of plate steel to form tubes. This process is very similar to the welding of ship plates. But I do not known of any machine which is especially adapted to work the steel after the welding operation.

One trouble with the hammer is the lack of penetration. "A blow creates in a metal practically nothing but compressive strains, which act chiefly in the vertical direction, and, by transmission, in the two horizontal directions. Because the pressure is relieved almost as soon as felt, the elasticity of the metal causes it to recover somewhat from the effect. This makes the effect of hammering superficial. Also the amount of yield to it is not great in proportion to it is not great in proportion to its force, and therefore it takes more pressure to accomplish a result than would be the case if the application were slower. This makes hammering a slow process of reduction, but results in a better and more uniform working of the crystals on the surface at least, which is one of the chief reasons for the superiority of hammered over rolled material. Another reason, perhaps even more potent, is the exact control of the operation which can be exercised by the expert forger, especially his control over the temperature at which the work is finished, and over the varying forces of pressure applied at different stages and temperatures. On the other hand, the effect of forging extends only skin-deep from the upper and lower surfaces."*

Cold Drawing to Improve Strength

Perhaps a mechanical device could be produced which would exert an action superior to that of the hammer and more like that of the rolls in a rolling mill. It is quite probable, too, that the requirement mentioned in the preceding excerpt, which calls for cold working, can be more adequately and safely met by mechanical means. This is especially true if semi-skilled labor is employed. With a machine the regulation may be exact and uniform, insuring continuous movement of the steel particles, although small for any one moment. For example, cold drawing would be a very effective means of improving the strength of the material. Tremendous pressure, however, would have to be exerted in this process.

It will be easily gathered from the foregoing that the simple hammering indulged in by a lot of oxy-acetylene welders can be counted on but slightly. In the hands of a skilled welder who understands the thing at which he is aiming and the way to get it best with such a tool, the hammer is doubtless a good thing and the work will probably be better for it. This is saying less, however, than that a full restoration can be thus accomplished or even approximated. In the hands of an ordinary oxy-acetylene welder, the hammer's usefulness would appear to be greatly limited.

After all is said and done, the reheating method appears to be the better thing. It is all-penetrating, seeking out the regions adjacent to the weld and also regions inside the mass. It is not, or at least need not be, superficial in its action thus surpassing the hammer. Furthermore, heat is easily applied. In the first place, we have as a convenient source of heat the enveloping flame which surrounds the little white working flame. The temperature of this flame is not excessive—like that of the white flame—besides, it is safe, because of its character as a reducing agent. It has a great appetite for oxygen, so that it may be depended upon not only to bring oxygen to the heated metal, but even to protect it from outside oxygen. Oxy-acetylene welders have been using this enveloping flame as a means of treating the weld, but that they have generally done so intelligently I am not prepared to vouch. The re-heating process, as has already been explained, gets its restorative results by heating up from a temperature point below medium cherry red (1,274 degrees Fahr.). This is to be regarded as essential. It is not enough simply to wave the big enveloping flame over the newly welded work. Attention must be directed to starting the heat from a sufficiently low point—a cooling off must be accomplished first of all. It does not matter how cold the work is allowed to get. It may be a black heat or it may be stone cold. The point is to get it below 1,274 degrees. Naturally, in this re-heating procedure it is cheaper to heat up from a black heat than from a stone cold condition.

Action of the Enveloping Flame

But this re-heating does not have to be done with the big enveloping flame. This flame is a good one, especially since it has a reducing quality; but it is quite expensive, particularly in the present case. Sometimes there are uses for the enveloping flame which are advantageous and economical. This flame may at times be so managed as to provide a means of pre-heating without interfering with the simultaneous employment of the white working flame. When this can be done, the enveloping flame heats the work up through the early stages, thus relieving the white flame to this extent. To put this idea into use on steel plates in a ship's side, the torch might be controlled in a frame or bracket in such a way as to compel half of the enveloping flame to lie along the seam ahead of the white flame. The Edison Storage Battery Company has so used the oxy-acetylene torch in welding the vertical seam in the sheet steel containers which constitute part of a storage battery cell. The torch is held at a fixed angle by a holding device. The work is held in a clamp which carries it beneath the flame. The clamp is of such form as to divide the enveloping flame into two streamers, one lying along the seam ahead and one lying along the seam to the rear. Naturally, with the work fixed as in a ship's hull, it would be necessary to move the torch. The workman may do this or it may be done with a device adapted for shifting along the seam. This arrangement is calculated to quicken the welding operation, thus saving the time of the workman and reducing the expense for oxygen and acetylene. It is to be distinctly noted, however, that it does not provide for the restoration of the grain size of the steel.

To deal with the grain size, there must be an interruption. After the welding operation, the weld and adjacent work must cool, at least to, say, black heat before the re-heating begins. Consequently, the enveloping flame could not always be used simultaneously with the working flame, the latter doing the welding and the former doing the restorative work. There are, however, less expensive flames to use for re-heating—city gas or natural gas. That they shall act with great power is not so necessary as that they will not project products of combustion of a harmful character on to the metal. This point covered, almost any form of fuel will do that is reasonably manageable and capable of producing enough heat to bring the seam and adjacent regions up to temperatures ranging from full cherry red to, say, orange.

Objection to Refined Iron

It has been customary among oxy-acetylene welders working on steel to use some pure form of iron for the new metal to be put into the groove—Norwegian and Swedish iron and one or two American brands of refined iron. The idea seems to have been to prevent burning by supplying little or no carbon. The new metal is ordinarily in the form of a rod. Naturally, in moving this rod about it is liable to be exposed to the air. If it contained much carbon, the ordinary workman would probably be burning the hot end continually. Besides, the use of refined iron is at best only a partial remedy against carbonization, since the adjacent work may still be affected. Furthermore, it does not deal at all with the condition resulting from big grains.

A second objection to the use of refined iron for the restoration of the quality of the steel when re-heating concerns the matter of the normal strength of the material prior to any deterioration from any source. It is well known that iron is by no means as strong as steel. Only a comparatively few people know, however, that the tensile strength of steel is strictly proportional to its carbon content. This rule covers at least all steels below tool steels. Each small addition to the carbon percentage means a considerable addition to the strength.

H. H. Campbell gives, in effect, the following rule: Beginning with steel of a zero carbon content—40,000 pounds per square inch of cross-section is assumed as the ultimate tensile strength of basic or open-hearth metal— for each 0.01 per cent. added to the carbon content, 1,000 pounds is to be added to the initial valuation of the strength at 40,000 pounds.

It may be gathered from the foregoing that pure iron is hardly in the same class with steel. A weld made of pure iron will probably consist of material weaker than the adjacent steel plates, if the latter are of first quality, even if no deterioration of the iron occurred in the welding process.

Another Objection and Summary

I have also further objections to make to this custom. From information about iron and steel which has been developed during recent years, it is understood that the re-heating process is quite successful with steels containing between 0.50 and 0.90 per cent. of carbon, but less so with steels containing smaller percentages.

To sum up, the oxy-acetylene process can probably be employed with success in marine work, not only in connection with ordinary miscellaneous jobs, but with work of welding the joints in the hulls of steel ships. But—and note this "but"—if only the ordinary procedures are employed, the tensile strength of the material at and near the weld is to be reckoned as decidedly less than that of the plates. Restorative measures are possible, but they must be applied intelligently and adequately.

Halifax.—The use of the Public Market Building for a mold loft has been requested by the Halifax Shipyards, Ltd. The intention was to lay the first keel early next month, and they had been unable to find a suitable building, except the market. The letter has been referred to the City Engineer.

WELDING IN RAILWAY SERVICE

Economies Realized

The Sayre shops of the Lehigh Valley Railroad claim the distinction of having turned out, about five years ago, the first completed welded firebox placed in service on an American railroad, and the plant is still turning to good account the economies possible through the use of oxy-acetylene and electric welding.

So far have improved methods of doing boiler work progressed at this plant that locomotive fireboxes are regularly renewed without removing the boiler from the frame, it being the practice to cut out the original firebox and put in in three sections, welding up all seams and joints. Among other expedients employed is that of dispensing with the studies at the corners of the mud rings, the practice being instead to countersink holes through the firebox sheets and into the mud rings sufficiently to get clean metal, and then spot weld the sheet to the mud ring by filling up the holes with the welding torch.

It has also become the regular practice to reclaim car and tender axles having worn collars by the oxy-actylene torch. The collar is built up the required amount, and then machined to the standard contour. In case the material deposited is found to be too hard, resort is had to the process of annealing the ends of the axles to enable the lathe tool to take hold. The expense involved in this process is given as $2.34, as compared with $20, the approximate cost of new axles for 50-ton cars. In cases where the rocker or tumbling shafts of locomotive valve gear mechanisms have become worn these parts are built up to size and restored to service at a fraction of the expense involved in renewing them. Loose fits on the crankpins and driving axles of locomotives are similarly treated. Locomotive driving box shoes are attached in the same manner as are the firebox sheets at the corners of mud rings—that is, by spot welding.

Cracked sylinders, which to replace new would cost anywhere from $800 to $1,200, are restored to service by autogenous welding at a cost that is insignificant in comparison. Broken engine frames are regularly welded in place, and miscellaneous lugs and brackets, including those on air pumps, are also restored by this means. A further economy to be observed at the Sayre shops and one in which the oxy-acetylene torch plays its part is the cutting out of blanks from old boiler shells from which locomotive driving brake heads are pressed in the bulldozer. The expense of making these heads amounts to about 35c each, as compared with more than $2, the present cost of these parts if made from malleable iron or steel castings. So fully is the value of autogenous welding appreciated by the mechanical staff of the Lehigh Valley Railroad that part of the standard equipment at each of its modernized engine terminals consists of an electric welding equipment The types of machines which represent with its automatic control panels.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

Ways to Shorten Arithmetical Calculations

Many Short Cuts Are Possible in Mathematical Calculations—Result in a Considerable Saving of Time—Checking of Multiplication Ensures Accuracy

By DONALD A. HAMPSON, Assoc. Mem. A.S.M.E.

In most shops and offices there is some one man who is known to be "quick at figures." It will be found as a rule, that that man practises various short methods of arithmetic and does many of his calculations mentally, also that he keeps up his speed by constant applications of these, even though no time is saved in some instances. To be able to calculate while on the feet is a valuable attainment; of course, extended calculations are impossible, but often these may be reduced so that they are possible, if a person memorizes a few rules and keeps in practice by being always on the lookout for chances; mental arithmetic used to be taught in the schools (and perhaps is yet) and many of the executives of to-day owe their start to the fact that they acquired a reputation above their fellows from that training. Some of the short methods are great time savers on everyday work, though not all can be performed mentally. About the only way in which these appear to shop men is when a contributor offers a single application in one of the trade papers; the reader passes this by with a mental note for the future, but when he wants it most, he cannot find it. The following are offered in the hope that collectively they will be retained and studied, memorized and put into practice. Some readers are familiar with them all, others will say, "I learned that in school, but forgot it years ago," and to others they will be entirely new.

Cancellation

Handling small numbers is so much easier than large ones and the chances for errors are so much less that every calculation should have its units reduced to smaller ones, if possible, at the very beginning. The everyday formulas and equations of applied mechanics form conspicuous examples—horsepower and weight and speed calculations are typical. Assume that the diameter of the driving pulley to put on the main shaft is wanted, and the other pulley sizes and the speeds are all set down as follows in the well-known formula:

$$D = \frac{1600 \times 8 \times 6}{150 \times 16} = \frac{76800}{2400} = 32$$

$$D = \frac{\overset{32}{\cancel{1600}} \times \cancel{8} \times \overset{3}{\cancel{6}}}{\underset{5}{\cancel{150}} \times \underset{4}{\cancel{16}}} = 32$$

If done by multiplying out, the result is as shown first and involves putting down all the figures; if done by cancellation, as shown second, the result is obtained almost by inspection and in far less time.

Fractions are one of the commonest mediums of calculations, and one of the simplest, but many men (and youths just out of school) are scared at their mention. They appear less formidable if kept reduced to their lowest terms. Whole numbers multiplied by fractions are frequent causes for mistakes when the whole number is first multiplied by the numerator, and then the division performed; while if the number is divided first by the denominator of the fraction and then the quotient multiplied by the numerator, the terms handled are smaller, with consequent less chance for mistakes. Thus 7-8 of 24392 is more easily done.

$$\begin{array}{r} 8\,\underline{|24392} \\ 3049 \\ \underline{7} \\ 21343 \end{array} \quad \text{than} \quad \begin{array}{r} 24392 \\ \underline{7} \\ 8\,\underline{|170744} \\ 21343 \end{array}$$

Division of Fractions By 2

Division of fractions and mixed numbers by 2 is a daily task, no matter how complete blue prints and instructions may be. When a fraction such as 18-32 appears—a fraction with an even numerator—one mentally reduces it to the simpler form of 9-16 on inspection. But if the fraction to be divided by 2 is, say, 19-32, we often find a person going at it as

$$\frac{19}{32} \div 2 = \frac{19 \div 2}{32} = \frac{9\frac{1}{2}}{32}$$

and then going through a process of reducing that to the result, 19-64, instead of following the rule for such cases of leaving the numerator unchanged and doubling the denominator. Then half of 19-32 becomes

$$\frac{19}{32 \times 2} = \frac{19}{64} \text{ and } \frac{17}{57} \div 2 = \frac{17}{57 \times 2} = \frac{17}{114}$$

If a number like 10 13-32 is divided by 2, the whole number is divided mentally and the fraction likewise, following the rule just laid down, the result being 5 13-64.

Mixed Numbers Divided By 2

But if the whole number of a mixed number happens to be odd, the division is not so easily accomplished unless the following rule is applied. For the integer, divide the next lower even number by 2; for the fraction, the denominator is twice the original denominator and the numerator is the sum of the original numerator and denominator. Several examples will illustrate this,

Divide $5\frac{17}{32}$ by 2
Next lower number is 4
$4 \div 2 = 2$ (1)
$2 \times 32 = 64$ (2)
$17 + 32 = 49$ (3)
And the quotient becomes $2\frac{49}{64}$

$1\frac{11}{16} \div 2$
Denominator $= 2 \times 16 = 32$
Numerator $= 11 + 16 = 27$
Quotient $= \frac{27}{32}$

$395\frac{7}{8} \div 2$
Half of $394 = 197$
Half of $1\frac{7}{8} = \frac{15}{16}$
Therefore $395\frac{7}{8} = 197\frac{15}{16}$

which is one of the handiest short cuts.

Simplifying Fractions

Fractions often are more accurate and faster than would be the solution if they were changed into decimals. A practical application is afforded by the following, which was the result of substituting figures in a well-known formula

$$\frac{\frac{1}{2} \times 7854 \times 3\frac{1}{2} \times \frac{3}{8}}{9 \times \frac{7}{18} \times 4 \times 12}$$

where a first change is made by writing 7-2 in place of the mixed number. Then by the rule that when a fractional numerator or denominator is present, the denominator may be changed to the other side of the line of division if accompanied by the sign of multiplication, we write

$$\frac{\frac{1}{2} \times 7854 \times \frac{7}{2} \times \frac{3}{8}}{9 \times \frac{7}{18} \times 4 \times 12}$$

which equals

$$\frac{1 \times 7854 \times 7 \times 3 \times 18}{9 \times 7 \times 4 \times 12 \times 2 \times 2 \times 8}$$

and proceed to cancel for a quick and easy solution. By the same rule other fractions are rendered "harmless," as

$$\frac{\frac{7}{8}}{10} = \frac{7}{10 \times 8} = \frac{7}{80} \qquad \frac{10}{\frac{7}{8}} = \frac{10 \times 8}{7} = \frac{80}{7} = 11\frac{3}{7}$$

Dividing By 12½

We often encounter the number 12½ in dividing 25 or 50, and almost as often have to continue the problem with 12½ as the divisor. An easier way than setting down the numbers and performing the division is to multiply the number by 8 and point off two decimal places to the left. Thus 24550÷12½ = 1964, but that cannot be done mentally, whereas 24550x8 = 196400, and pointing off becomes 1964. This can be done mentally or by writing the result without setting down the factors. If desired, the pointing off may be done first—then 245.50x8 = 1964.

Squaring Numbers Ending in ½

A number ending in ½ as 6½ may be squared mentally. Instead of performing the multiplication on paper it is done in the head simply—7x6 plus ¼ is 42¼. The rule is, multiply the number by one more than itself and add one-quarter. To illustrate with a larger number, square 19½—(one more than 19 is 20) then 20x19+¼ is 380¼, or 380.25 if we choose to use decimals.

Squaring Numbers Ending In 5

Squaring a whole number ending in 5 is done by a somewhat similar process: First, drop the 5; then multiply the remaining number by one more than itself; to this product affix 25 and the result is the desired square. Example: square 325. Dropping 5 leaves 32 and one more than 32 is 33; then 33 × 32 = 1056; 25 affixed (not added) to 1056 = 105625. It is a relatively short task to square this number by the usual long multiplication, but if the method given above is fixed in the mind ready for instant use, some time is saved by its use and when the number has four figures or more (as 4525) less computation is necessary. Numbers of two figures may be squared mentally—65² would be x 7 with 25 affixed, becoming 4225 almost at a glance.

Checking and Proving Multiplication

In checking over a multiplication they have made, many persons will commit the same error (mentally) that they did when setting down the figures, a thing that has been done so often that an entirely different proof is far better. The proof that follows is one of the best and quickest. Add the individual figures of the multiplicand and if the sum is greater than 9 add these figures to get a sum of only one figure; do the same thing with the multiplier; multiply these sums and the product will equal the sum obtained by adding the figures of the product of the original multiplication until a sum of one figure is reached. This is easier than it sounds, as witness below—

```
  6293     6+2+9+3 = 20    2+0 = 2    2x3 = 6
   372       3+7+2 = 12    1+2 = 3
 -----
 12586
44051
18879
-------
2340996    2+3+4+0+9+9+6 = 33    3+3 = 6
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Contracted Multiplication

Very often a multiplication involves more decimals than are needed for accuracy. Innumerable calculations would be amply correct if the result were stated to one or two or three decimal places. A method known as short or contracted multiplication cuts out a good deal of work and gives a result to as many decimal places as wished. The example following shows how the work is set down and performed. Required to multiply 12.472 by 1.234.

```
 12.472
  1.234
 ------
 12.472  = 1 x 12.472
  2.494  = 2 x 12.47
   .372  = 3 x 12.4
   .048  = 4 x 12
 ------
 15.386
```

Though in this case both numbers have the same number of decimal places, it is simpler in any case to place the decimal points under one another (if one of the numbers had had more than three decimal places, those over three would have been disregarded). Proceeding with the multiplication it will be noted that instead of following the usual order and multiplying with the 4 first, the start is made at the other end with the 1 and the result, 12472, set down, keeping decimal points in a vertical line. After this multiplication the last figure in the multiplicand (2) is crossed off and disregarded henceforth. Then 12.47 is multiplied by 2. the product set down in line. and another figure (7) crossed off. This is continued and the sum is the final product, 15.386, to three decimal places. To give a clearer idea of the order in which the multiplying is done and what figures are crossed off, another row of figures had been placed at the right showing how each individual product was obtained. If the multiplication had been performed in the usual long way, the result would have been 15.390448, which is .004 greater than the abbreviated method and sufficiently close for many purposes.

A way of squaring numbers of two or more figures will be given. For an example we will take the number 78 and square it. The rule is: Subtract the number from the next higher tens number, subtract the difference thus obtained from the original number, and multiply this new difference by the tens number, and to the product add the square of the difference first found. This seems very involved, but it isn't, as may be seen below and the process can usually be worked out mentally. In the case of 78, 80 is the next higher tens number: if the number were, say, 124, the tens number would be 130 and the procedure would be the same.

```
80 — the next higher tens        78
78 — the number                   2
--                               --
 2 — the difference              76
1st subtraction                  2nd. subt.

76 x 80 = 6080     2 x 2 = 4          6080
                   squaring the          4
                   difference         ----
                                      6084
multiplication                        the answer.
```

Time Savers for Weight

Along with the strictly mathematical short cuts above there are a couple of others that will help the man who has to do with weights and volumes of metals.

In case the weight or volume of a round bar is wanted, use ¾ of the square of the diameter instead of .7854. This enables many estimates to be made mentally and is near enough when the weight is not over two figures and the material steel ir iron.

It is not hard to remember that ½" steel weights 2-3 of a lb. to the foot, ⅝" weighs 1 lb., ¾" weighs 1½ lbs., 1" weighs 2 2-3 lbs., 1½" weighs 6 lbs., 2" weighs 11 lbs.

A rule to find the weight per foot of length of any round steel bar is: square the number of quarter inches in the diameter and divide this by 6, the result is the number of pounds.

For rough estimating the weight of cast iron, wrought iron and steel may be taken as ¼ lb. to the cubic inch, or four cu. in. to the lb. Bronze and copper are heavier—approximately three cu. in. to the lb. or 1-3 of a lb. to the cu. in.

DEVELOPMENTS IN SHOP EQUIPMENT

Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

LITTLE DAVID PNEUMATIC CAULKING MACHINE

With the demand for ships and more ships to make good the losses caused by U-boats, and with the shortage of skilled labor, due to the war, a tremendous need arose for mechanical tools to increase and speed up the building of ships, which was a pretty slow process in the days when all the work was all done by hand.

CAULKING MACHINE

To-day, a large percentage of the work is done by machines—the power used being compressed air. The following will give some idea of the various uses: riveting, chipping, drilling wood and steel plates, caulking steel, caulking oakum, grinding, sawing, driving drift bolts, and trenails on wooden boats, blowing cement, blacksmith forges, bolt heading machines, planing and dubbing machines, painting and operating small hoists.

The tacking of oakum by mechanical means on the hulls and decks of wooden ships and on wooden decks of steel ships, was never a success until an inventor on the Pacific Coast designed the Little David Pneumatic Caulking Machine, which meets the peculiar requirements necessary, such as coiling or tacking cotton or oakum (either machine or hand spun), to any required depth for final horsing.

The machine is easily handled, weighing only 13¼ lbs. The length over all is 22 inches, and the air consumption at 90 lbs. is 20 cu. ft. of free air per minute. In appearance the Little David pneumatic caulker is similar to a pneumatic riveter, but its action is totally different, being on the same principle as the sand rammer or sewing machine. Guide wheels are used to keep the machine in line with the seam. The stroke being always the same, the depth to which oakum is forced in the seam is regulated by the operator's pressure on the tool.

The caulking machine operates at the rate of 1,500 tacks per minute, either coiling the oakum or running it straight.

A metal finger at one side over which the oakum passes before it is forced into the seam by the iron, regulates the coiling or tacking. For a long tack the iron is allowed to pass further; for a short tack the normal stroke or position is used.

In standard tack work, such as 5 in. or 6 in. planking, the method employed in certain U. S. yards is to run in the first three strands almost straight to allow cotton or oakum to penetrate farther. The first horsing is then given. The seam is now filled up with two more strands, having these well pinched or coiled, and again horsed. Care must be taken to see that there are no lean places or lumps in the material, otherwise skipping or uneven caulking will result.

All seams on 5 in. or 6 in. planks should be reamed to a depth of 2¼ in. and about 3-16 in. to ¼ in. open at the top.

For the deck with 3 in. planking, ream about 2¼ in. deep, and from ⅛ in. to 3-16 in. open at the top.

Caulking decks, until recently, has always been a slow and tiresome job, but the Little David Caulking Hammer seems to have changed this, as the following test at the Vancouver yard of the G. N. Standifer Corp. proves: 3,100 ft. of single thread oakum was driven home, and time test showed 35 ft. of one seam was completed in 3½ minutes. At the Fraser, Brace and Company's yard, Montreal, where they were using a number of these caulking machines, the following results were obtained in the course of their ordinary work, and without any special test: 41 deck seams, 21 ft. long, were completely finished—that is, both tacked and horsed—in 2½ hours.

In this case two men and two machines were employed, one machine fitted with a 1-16 in. iron for tacking, and the other with a 1-8 in. grooved iron for horsing.

In tacking, the first operation an iron 1-16 in. thick is used. For the horsing of the decks an iron 1-6 inch thick is used, or in some cases we have noted a 3-16 in. iron with a groove, which seemed a decided improvement. A few seconds is all that is necessary to change from one iron to the other.

As stated previously, this No. 23 Little David caulking machine will tack oakum in any part of the hull or deck, but will only do horsing on the deck. The inventor is now endeavoring to design a suitable horsing machine.

It has been estimated that this Little David caulking machine will take the place of ten mechanics. A man by hand will take an average of three days to caulk in a bale of oakum; with a machine the bale will be caulked in an average time of 2½ hours.

CAULKING DECK PLANKING

This new tool seems to have filled a big vacancy, and from all appearances is here to stay. Wooden ships may not be built very much longer, but the building of steel boats with wooden decks, which require caulking, will be one of Canada's large industries in the future.

IMPORTANCE OF THE LABORATORY IN THE MODERN FOUNDRY

THE importance of scientific guidance in industrial pursuits has been very forcibly brought to the attention of almost every manufacturer in the past few years. Many industries have been compelled to pay the very strictest attention to the composition and physical properties of the materials entering into munitions of war.

The foundry has not escaped this general inquiry into ways and means of bettering plant processes, and while the semi-steel shell so far as America is concerned was only coming into its own the advice of French authorities may well be applied to foundry work in general.

General Camon and Lieut. Rouger in their investigation into the semi-steel as a material for shells made some very pertinent observations regarding the industrial laboratory. They found in an exhaustive inspection of foundries made in the latter part of 1915 and the first part of 1916 that a great variance was observed in the results obtained by the French founders. While some of them had a number of rejections of only 10 or 15 per cent. other foundries exceeded 50% rejections on the 155 mm. shell. These show that for the latter there were systematic errors in the latter places which should be investigated and eliminated.

For this reason it was advisable to sum up in a concise note the general principles which are at the basis of the development of semi-steel and to draw attention to the most important of these points. Since then the establishments had encountered new difficulties because the iron and cokes were no longer of as good a quality as those which had been used at first. Means had to be found to remedy this condition and different plants were communicated with as to the result of their studies in this connection. Some well known foundries had thought they could handle semi-steel as they had handled ordinary cast iron, by pure experiment. They had the troubles which they deserved, having been compelled either to abandon manufacture of semi-steel shells or to adopt, like their colleagues, methods based upon chemical analysis.

Obviously one could not fail to recognize the value of experience acquired in the course of long practice, but this experience must be associated with logical investigation.

Lacking laboratory analysis some manufacturers assumed that for each kind of piece to be cast the fusion bed or cupola mix, would be composed of definite proportions of iron marked as to its source and the appearance of the manufacture. Consequences resulting from this procedure were made apparent in—

First, the foundryman was at the mercy of certain producers; the lack of iron of a certain origin became the cause of embarrassment in the manufacture.

Second, the constituents of an iron of definite origin are always essentially variable, for they depend not only upon the ore but upon methods of manufacture. Even assuming an ore always of the same grade any mistake or accident in the operation of the blast furnace has its effect upon the chemical composition. These variations cannot be recorded with sufficient accuracy without the aid of the chemical laboratory.

Third, when a series of pieces is defective in quality of material it is more difficult without a laboratory to investigate and to remedy the cause.

Fourth, when the composition of the iron which should be obtained is definitely known fusion beds may be arranged, with the help of the laboratory, with materials at hand by varying their proportions.

By its very presence in the foundry the laboratory exerts a good effect upon the quality of the metal received; thus a Berlin foundry found after it had established a laboratory that a notable improvement resulted in the metal received, particularly as regards the sulphur content, the purveyors to avoid exposing themselves to a refusal on the part of the laboratory selected their product themselves and kept back sulphurous metal for the foundries which could not make analyses on reception.

To-day foundries working with semi-steel which do not have a laboratory and are satisfied with analyses made outside are exceptional in France.

FUTURE AND SOURCES OF INDUSTRIAL ALCOHOL

Possible Sources of Supply

THE appointment of a Government Committee to investigate the available sources of supply of alcohol, with particular reference to its manufacture from materials other than those which can be used for food purposes, the method and cost of such manufacture, and the manner in which alcohol should be used for power purposes, has served to focus attention upon a problem of the most vital importance for England's post-war period.

For the purposes of war it was found possible to meet the needs of the explosives industry for both alcohol and acetone by a drastic reduction in the quantities of potable spirit bonded, by augmenting the capacities of the distilleries producing spirit, by importation of over-proof spirit from various parts of the Empire, and by increasing distillation from molasses. The alcohol thus obtained has been deprived practically entirely from materials otherwise available as food, and, indeed, in the case of molasses has been secured at the serious expense of the supplies ordinarily employed for stock-feeding. In the year 1916-17 the consumption of industrial spirit had reached a figure of upwards of four million gallons. With the close of hostilities a large part of this demand for alcohol in industrial processes will not be maintained. Nevertheless, it is confidently anticipated that the output of alcohol will not suffer any diminution, but, on the contrary, will be increased to many times its present magnitude.

Fuel Uses

The outlet for the alcohol of the future may be deduced from the terms of reference of the Government Committee, and also from the composition of the Committee appointed. The presence upon the Committee of Inquiry of a number of technical experts interested in petroleum supplies and their application demonstrates that the problem of alcohol is intimately connected with the development of motive power, in which a high-grade volatile fuel is consumed. The enormous increase in the applications of the internal combustion engine for transport on land, on sea, and in the air has placed a strain upon the producers of petrol supplies which shows no tendency to diminish. The oil supplies of the world, drawn upon to an ever-increasing extent, are rapidly becoming inadequate to meet the demands which arise. Thus, it will be necessary to turn more and more to other sources of fuel supply. Among these, not the least of future possibilities is presented by industrial alcohol, suitably denatured, in admixture with benzine, the production of which in large quantities from by-product ovens and town's gas is practically assured.

Grain and Potatoes

In this country, at present, alcohol is mainly obtained by fermentation processes from grain, together with some small quantities by distillation of molasses. In Germany production from potatoes by a combined hydrolytic and fermentation process has been largely used to supplement the grain fermentation process. The first stage in the operation consists of the conversion, by treatment with acids, of the starch content of the potato into glucose, a soluble sugar, which is then fermented to yield the alcohol desired. The raw materials for the preparation of starch, such as rice, maize, and sago, are also suitable for use in the production of alcohol by this process. In the main, however, the starch content of such materials is used as such, or is converted into glucose only, to be used in the many sweetening processes for which this product is suitable. In all of these alternatives, however, potential food supplies are consumed, and during periods of stringency, such as now hold, economy of such supplies is a problem of the utmost urgency.

Of the possible sources of alcohol supply other than those which have just been enumerated, attention has been directed to the utilization of wood waste, and to the synthetic production of alcohol from calcium carbide, a product which can be produced abundantly and cheaply in the electric furnace, provided that cheap electric power is available.

Utilization of Wood Waste

The principal constituent of wood is the complex carbohydrate commonly known as cellulose, and this is available in abundant quantities in the wood waste obtained in the operations of the timber trade. The problem of recovering alcohol from such material consists in the conversion by disintegration of the cellulose constituent of the wood into fermentable sugars, from which alcohol can then readily be obtained. The possibility of effecting such a conversion has been known for more than a century, and many attempts at commercial realization of the project have been made. It is only recently, however, that success has become practicable, largely owing to detailed study of the problem by the lumber interests in North America, stimulated by the assistance of Government investigation, such, for example, as that conducted by the U. S. Forest Products Laboratory at Madison, Wisconsin, U.S.A.

To convert the cellulose of wood waste into sugars suitable for alcohol fermentation, treatment with dilute acids is employed. Dilute sulphuric and hydrochloric acid and, more recently, sulphurous acid have all been tried. In the modern developments of the process the wood waste is saturated with water containing 1 per cent. of acid, and the mixture is digested at suitably elevated temperatures, corresponding approximately to a pressure of 75 lb. to 100 lb. of steam, for a definite interval of time. The moisture content is kept as low as possible for the sake of economy in the subsequent neutralization and concentration processes as well as for greater ease of handling the material and regulation of the operating conditions. It has been found that a 50 : 50 wood-acid liquor is a convenient material for such purposes.

After the process of digestion the separation of the sugars from the woody residue is effected in standard beet-sugar diffusion batteries provided with acid-proof linings. Neutralization of the acid liquors follows, generally by means of lime or a high-grade limestone. The sugars are then fermented in accordance with standard practice, a four-day fermentation period being employed, and the alcohol is subsequently distilled and rectified in the usual way.

Comparative Yields

As to yields, obtained and possible, it may be observed that 25 to 28 per cent. of the dry wood may be rendered soluble, and of that percentage as much as 80 per cent. is fermentable sugar. This corresponds to 10-11 per cent. alcohol, or 35 gallons of 95 per cent. spirit per dry ton of wood. Thus far, in actual practice, the yields have scarcely exceeded 20 gallons per ton, as contrasted with a yield of 80 gallons per ton from corn. It is obvious, therefore, that the amount of material handled in parts of the plant producing alcohol from wood will be four times as great as in a grain distillery with equal output. On the other hand, there is a large margin in the cost of raw material in favor of alcohol from wool waste, and the fuel charges are always a much smaller item than in a grain distillery, since most sawmills produce waste in excess of their own power requirements, and the woody residues from the digestion process have a fuel value after partial dehydration. With modern plant the economic aspect of the problem becomes steadily more favorable, and the wood waste alcohol industry may leap forward to commercial success as the shortage of other available fuels for internal combustion engines becomes more acute. Such developments, which have so far been confined mainly to the United States, may be expected to occur also in Canada and other timber-producing areas.

A development of the alcohol industry from wood as raw material, which has been greatly stimulated in Sweden and in Germany during recent years owing to the rigorous curtailment of imports of petroleum spirits, is associated with the paper-making industry. Wood pulp is produced from pine-wood material in considerable quantity by digestion of the wood with solutions of sulphite of soda. The sulphite lyes contain fermentable sugars, and are therefore potential sources of alcohol. Apparently the difficulties associated with the dilution and composition of the liquors have been successfully overcome, since 11 factories are now in course of erection in Sweden, a development which suggests that Scandinavia will soon be independent of petrol supplies.

Synthetic Processes

To a country such as Britain, with no considerable timber areas, the synthetic processes of alcohol manufacture must be of prime consideration. As developed hitherto calcium carbide is the starting point of the synthesis, a fact which suggests the necessity of cheap power production, as outlined in recent Departmental reports. By treatment of the carbide with water, acetylene gas is obtained, and this on reaction with water in presence of a catalytic material is converted into acetaldehyde. From this latter, by a further process of catalytic reduction, alcohol results. The conversion of acetylene to alcohol thus involves two separate catalytic processes. The first, the process of hydration with water, is carried out in presence of suitable acids, generally with mercuric oxide or mercury salts present to promote the rapidity of the process. Sulphuric acid and acetic acids with the corresponding salts of mercury have been employed, and, as they are unchanged in the reaction they can be utilized for long periods of time. The aldehyde produced is subsequently passed in the form of vapor, together with hydrogen, over a catalytic material consisting mainly of reduced nickel. At 140° C. 80 per cent. of the aldehyde may be converted into alcohol by one passage over the nickel, and the residual hydrogen and acetaldehyde may be returned to the catalyst, after being freed by fractionation from the alcohol formed. In this way high efficiencies may be obtained.

It has been recently stated that, operating in this manner, successful production has now for some time been carried out by the Hoechst Farbwerken in Germany and by a Swiss company, the Longa Electricity Works, at Visp, Switzerland. It is hoped that this latter company will shortly be in a position to cover the total alcohol consumption of their country with the synthetic product. The economy of the process is conditioned mainly by the initial cost of carbide, which must necessarily be extremely low to furnish alcohol at a price which would compete successfully with petrol at normal rates. Large-scale production in favorable conditions as to power costs will certainly be necessary.

The production of alcohol via acetaldehyde does not exhaust the possibilities of synthetic processes. Large-scale production of ethylene hydro-carbons would lead to the development of a synthesis by direct hydration, from which alcohol would result in a one-stage operation. The whole problem is as yet in its infancy, and a considerable amount of coordinated research will be necessary to establish the alcohol industry on a sound basis. The need for alcohol as fuel becomes increasingly urgent, especially in areas such as the United Kingdom, in which natural resources of motor fuel are but small. The restrictions under which the manufacture of industrial alcohol has labored in the past will disappear inevitably as the need for alcohol grows. The growth of the industry will follow the present stimulation of investigation and research.—

CASTING IN ALUMINUM

By M. M.

The use of aluminum for castings which are not subject to great direct pressure is likely to increase, because of its lightness and its freedom from oxidization at atmospheric temperatures. It is of great value in aeroplane and submarine work especially, but it is not much used in a pure state. Where lightness and not strength is the chief consideration, alloys that have a very high percentage of aluminum are used, probably only about 1 to 7 per cent. of copper being added; but if toughness is essential and great tensile strength, aluminum bronze composed of 90 per cent. of copper and 10 per cent. of aluminum is good. This mixture is satisfactory for sea valves and small propellers, as it withstands the corroding influence of the sea water. What is called aluminum brass is really just an addition to a small percentage of aluminum to a copper and zinc mixture. It makes a tough alloy suitable for forging, but the percentage of aluminum is so small, probably 3 or 4 per cent., that it makes no appreciable difference to the weight of the casting. One great advantage of this mixture is that if a slight alteration is wanted in a casting the metal will draw out. For small bed plates, gear cases, and brackets, a very suitable alloy is 85 parts of aluminum to 11 parts of zinc and 4 parts of copper. It is true of all casting, but perhaps more especially of aluminum, that a great deal is found by trial, consequently mixtures are varied slightly to suit special classes of work.

Aluminum is a difficult metal to melt. It oxidizes readily, and the furnace temperatures should consequently be low. A gas or oil furnace is much better than the ordinary crucible fire. When it attains a dull red heat it should be poured. A flux is not necessary if care is exercised, but some common salt or zinc chloride may be used, the metal afterwards being stirred and skimmed. In mixing aluminum alloys for small work the copper should be melted first, and when it is fluid the aluminum may be added and stirred up with an iron rod. It is better, however, to add it as half aluminum, half copper, because the melting temperature of copper being so much higher—over 800 deg.—than aluminum, there is a danger of overheating. In making this mixing alloy the copper should be melted first and the aluminum added in small quantities. The alloy is heated first. and then the aluminum is added. Of course, if a zinc mixture is used, the zinc as usual is added last.

Much of the success in aluminum casting depends upon pouring the metal at the correct temperature. This can be determined by skimming the metal as it is melting. When it is right for pouring there will be no oxidization, and the surface will be clear. There is much disputing as to the effect of re-melting aluminum alloy, and the results of experiments seem to show that a mixture which is rich in aluminum is generally improved by re-melting, but when the percentage of aluminum is small, its strength is reduced.

Care has to be taken when making molds for aluminum work that the ramming is not as hard as for ordinary gun-metal or brass castings. The shrinkage of aluminum is considerable, and if the sand is hard rammed, it will interfere with the free contraction of the metal, and distorted or cracked castings will be the result, otherwise there is not much difference then from ordinary brass founding. A good facing sand mixture is composed of one part of Mansfield sand to three parts of floor sand. For thin metal however, more floor sand should be used. It should be put through a fine riddle. French chalk or plumbago may be brushed over the mold. but occasionally a facing powder is dispensed with.

The cores for such molds should be well vented, as the metal is too light to force the gases out. An open sand is best, and sea sand is sometimes used with a strong binder.

Because of the shrinkage in such work, larger feeder heads are indispensable, especially if the metal is thick. As soon as the metal sets the casting should be stripped, and to facilitate this, some molders prefer wooden flasks, which are light, and thus easily handled. Apart from this advantage, however, although wooden flasks are very handy, as they can be quickly made, cast iron boxes are preferred by most molders.

ESTIMATING PHOSPHORUS IN BRONZES

By M. A.

Bronze drillings, to the amount of from 0.5 grm. to 2 grm., are dissolved in a mixture of 20 c.c. strong nitric acid and 10 c.c. strong hydrochloric acid, or, if preferred, 60 c.c. nitric acid (specific gravity, 1.135), and 10 c.c. hydrochloric acid. The mixture is digested for some time without boiling, until most of the red fumes have been evolved. If the concentrated acids are used, the mixture is then diluted to about 70 c.c. The liquid is next cooled and 40 c.c. of ammonia (specific gravity, 0.96) added slowly, with constant shaking, followed by 35 c.c. of niromolybdate solution, and the whole shaken well for a few minutes. The mixture is allowed to stand for one or two hours until the precipitate has settled out, when it is filtered, preferably on pulp, washed with water until free from acid, the filter and precipitate transferred back into the flask, excess of N-20 caustic soda run in from a burette, the whole well mixed and the excess of caustic soda titrated with N-20 sulphuric acid, using phenolphlathein as an indicator.

1. c.c. N-20 caustic soda = 0.00337% P. on 2 grm.

The method is based on the well-known volumetric method of estimating phosphorus in steel. It is best carried out in a 600 c.c. conical flask and a rubber stopper used in the final shaking.

Points

1. The digestion with acid must be long, to oxidize all the phosphorus, or results will be low.

2. Boiling or heating must not be too prolonged, or tin will be precipitated and will be difficult to redissolve.

A comparison of the method has been made with a gavimetric method, in which the tin oxide containing the phosphorus is mixed with Hepar mixture and fused. The resulting melt is dissolved in hot water, the solution acidified with a little hydrochloric acid, whereby the tin is precipitated.

The tin sulphide is allowed to settle, and is then filtered off, the filtrate being boiled to remove sulphuretted hydrogen; nitric acid is added and taken down to low bulk, and the phosphorus precipitated and estimated as magnesium pyrophosphate in the usual way.

The results obtained by the two methods on a number of commercial bronzes are given in the accompanying table along with the approximate composition of the bronzes.

					Phosphorus	
Copper	Tin	Lead	Zinc	Iron	Gravimetric	Volumetric
88.32	2.56	8.08	0.11	0.24	0.45	0.42
88.30	2.59	8.06	0.11	0.24	0.39	0.41
88.59	10.63	....	0.06	....	0.80	0.81
88.57	10.65	0.02	0.14	....	1.43	1.40
88.92	10.00	....	0.18	....	0.76	0.74
77.31	10.30	10.45	0.10	....	1.45	1.44
88.95	2.07	8.24	0.16	....	0.44	0.42
93.73	6.07	....	....	....	0.17	0 18
89.60	2.41	7.76	....	....	0.39	0.37
88.59	10.14	....	....	....	1.24	1.22
88.58	10.37	0.06	0.88	....	0.011	0.010
78.05	8.76	12.48	0.24	....	0.43	0.44

THE FUTURE OF IRON

In the course of his presidential address to the Staffordshire Iron and Steel Institute, Mr. G. Carrington prophesied that the demand for iron in the future will greatly exceed that of the past. Its greater suitability for sheets, whether black, painted, or galvanized, is generally conceded, its life being fully five times that of steel, and even in present conditions it is again ousting steel for railway and colliery work, ships' decks and hatches, and where there is exposure to severe weather or to acidic liquids. Then there are plates, girders and bars for bridge building and constructional and agricultural purposes, and particularly for ships; and he expressed the conviction that, given the material at a reasonable price (not the same price as steel, because it will always command a better price for these purposes than steel), we shall in our time see the all-iron ship. But it is necessary to devise methods by which the necessary output can be obtained, and in his opinion there is no way except by large gas-fired mechanical puddling and scrap furnaces of anything up to say. five tons, with corresponding mill and other necessary plant. There will then be no difficulty in producing ships' plates and girders in the large sizes now required, without which an iron ship could not be economically built. The rudder and stern may give trouble, and steel will perhaps be specified on account of the thickness, weight, and shape required, and also the relative unimportance of rusting, but for plates, girders, bars, etc., for bridge building and constructional work there would be no difficulty. A Puddling Research Committee has been formed by the whole of the iron trade associations of the country, and it is to be hoped that something may be done to relieve the puddler of some of his heavy work. At present it is proposed to confine the investigations to 10 cwt. furnaces, but while that proposal represents a great advance. Mr. Carrington thinks it is much too timid. Producers must learn to talk in tons where they now think in hundredweights, and iron can be produced as economically as steel only on the same scale.

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Unemployment is Dangerous

THE labor situation is not improving in this district. The only thing that is being done is the unloading of some hundreds of munitions hands every day or so. By the end of the month the shell plants of the Dominion will be done for, and the thousands that have worked there will be looking for something else to do.

If they do not find it they will be out of work. It may not take much reasoning to see that, but it is a fact so plain that it may be overlooked. Unemployment with prices at the present peak is a dangerous proposition for Canada.

Masses of men have felt their strength in recent years as they have never done before. There is more social unrest abroad now than there has ever been in the history of the country. These facts are patent to any person who is out enough to get in touch with the situation, and is honest enough to face the facts as they exist.

A season of unemployment with food and clothing and fuel at top-notch prices is too dangerous a thing to tinker with in this country just now of all times.

If Ottawa is going to move definitely the move should be made soon, if it is going to take the form of co-operation with the Canadian manufacturer, for it is to this source of employment that the people will have to look for some months to come to avoid an army of unemployed.

This country has the money and it would be a good and a sane investment to spend some of it in keeping the industrial and labor situation well ironed out until the cost of living shows some signs of coming down within shooting distance again.

Germany is "Out of Bounds"

PACIFISTS may try as much as they wish to seek easy terms for Germany in the making of peace, but every day that passes adds new evidence to the hell that has been turned loose in the name of German junkerism.

The man who would go out and preach hatred for the German simply because we had been at war with the German would be a fool and a traitor, but the man who can read the accounts of honest men as they describe what they have seen, and not have his whole being boil with indignation, is devoid of the semblance of manhood.

The anti-German feeling is growing without any urging. The chances are that we have not felt the full force of the movement. Remember we have some hundreds of thousands of soldiers who have yet to come home. These have seen atrocity in its worst form. They have come into contact with those that have felt to the limit the heel of the Hun. They have had an experience that a thousand years could not efface. And as these men come home, they will tell their experience. They will touch circles that have not been moved, and they will start influences and feelings that have been lying dormant. It will all grow into a tremendous anti-German feeling.

Germany stands not simply as a defeated country, but as an outlaw in the courts of civilization and an exile from the halls of decency. The murderer cannot wash his hands of the blood of infants and mothers, nor can the assassin come back into the company of decent men.

It's wasted effort carrying on a campaign against Germany and German goods. Germany's butchers in the last four years have blasted Germany's chances of getting a hearing in the commercial world.

Be Decent to the Salesmen

THERE are some firms, officials of which make it a point to turn down salesmen as a matter of policy. They know what they want and they apparently are satisfied that they know the place where they can secure it to the very best advantage.

When a salesman comes he can send in his card, and receive the information that the manager is too busy to see him, although at the time he may be trying to determine the difference between tweedle dee and tweedle dum, and wondering what he can find in the way of excitement to pass the rest of the day.

The manager who is too busy to see a good salesman is missing a lot, and he is not awake to his own best interests or to his firm's best interests.

Here's the way one business man put the case to CANADIAN MACHINERY this week. The gentleman in question has been a success in a large way. He has made money and he has made friends, and through it all he has retained a very great deal of genuinely good human nature. He stated:

"Right now we are trying to get our selling force back into shape for the stiff work that is ahead of them for after-war trade. They have had a chance in the last few years to become soft and easy. They're not the bang-up good salesmen they were before the war. I am out looking for pointers in salesmanship, and whenever I find anything that can be passed along to our men I consider that something worth while has been accomplished. For that purpose I am spending a little more time than formerly in receiving and paying very close attention to any salesman from a reputable firm that comes into our office. I listen particularly to any timely or appealing reasons he has at this time for pushing the sale of his lines. I watch to see if he has departed from the old path, and in a number of cases I have come across very good points that have a lot of common sense back of them. These I simply store away mentally, adapt them to our line of business and pass them to our salesmen as suggestions. I am finding it a very good way of gathering up a lot of new ammunition without very much effort."

Be civil to the man who is out representing his house on the road. He may be your competitor, and yet start some prospect thinking along a line that will start a sale in which you may benefit.

Don't get into the habit of telling the travelling man that you are too busy to see them. They know you are not. They might like it better if you would be frank and send out a shingle bearing the inscription, "I don't want to see you, so beat it."

We're inclined to think that the manager, who in these days of reconstruction, when lines are being re-shaped and policies put into the melting pot, has time to listen to the sales talk of the men on the road and see if he can find anything in their arguments that would strengthen the position of his own salesmen, has a breadth of vision that will bring his company well up to the top of the heap at the end of the year.

THE POSITION OF THE SMALL SHOP NOW THAT WAR WORK HAS ENDED

Editor CANADIAN MACHINERY:—

Sir,—

Montreal, Dec. 18.—There was one paragraph in the article headed as above, which appeared in your issue dated Dec. 5th, 1918, which particularly appealed to the writer, inasmuch as it appears to hit the nail on the head just about as square as it is possible to imagine. The paragraph referred to being:

"Canada does not stand in the place of a nation that has to deal in a niggardly way with the situation. It is better to blunder by two great efforts and consequent expenditures, than to court trouble by meeting the situation with the vision of a pinhead and the courage of a slacker."

Since the termination of European hostilities and cancellation of practically all munition contracts, there has been cast upon the high seas of commercial industry, hundreds of small engineering establishments, many of whom have been sawing wood, as it were, since the outbreak of the war, whilst others have not been so long employed upon the manufacture of the various parts required in the make-up of a shell or other parts required so urgently.

There is another class, however, by no means scarce, and one that is "meeting the situation with the vision of a pinhead," quite ready and more than willing to crawl into a hole, pull the hole in after him, and spend the rest of his life figuring out exactly how much he got away with, without having to make another gamble as it were, which, in any case was no gamble at all inasmuch as it was a certainty, and the most despised race track tout still claims that it is very unsportsmanlike to bet on a certainty.

It is hard to imagine any other circumstance that could possibly have brought to the surface so much talent and engineering genius, the same as the demands of the recent war has done, and in such a comparatively short time. Along the same lines of thought, it is just as difficult to imagine any other circumstance that could possibly have placed so many men in the position of acquiring sufficient money to even consider the possibility of pooling their money with that of others, and starting out as full fledged industrial organizations, and quite prepared to handle any and all of the multitudinous jobs that the larger and longer established shops were only too glad to have someone handle for them at, in many cases, princely figures.

Now the larger shops have been compelled to mark time, and in many cases lay off a large percentage of their help until such times as they are able to once more reorganize and enter upon a line of manufacture that they were formerly engaged upon, or some other peaceable line, these small fry referred to above are verging upon a state of hysteria for fear they cannot get hold of a line of manufacture that would bring returns commensurate with those of the munitions, or else for fear they have to hold their industrial establishments just so long that the profits will be eaten up by the mere fact that rent has to be paid, together with the insurance, etc.

Is it not deplorable to think that many of these men were brave enough to speculate, and pocket the certain profits so long as the other fellow was getting killed, but, immediately the other fellow became immuned from danger, so to speak, this "pin head" is painfully anxious to once more join the ranks of the "privates," and thus become relieved of any further responsibilities from an industrial standpoint.

Not many days ago the writer had occasion to visit a certain shop wherein had been employed some forty or fifty men. The present number did not amount to more than four or five. There were some twenty-five or thirty lathes, every one having a covering of some kind, and bearing silent testimony to the fact that their owner, or owners, had, to all intents and purposes, immediately upon the guns breathing their last "over there," covered each lathe with a look of remorse and a sigh of regret that the war was over.

Out of pure mechanical curiosity, one or two of the coverings were reverently raised (unseen) and in not one case had any oil or grease of any kind been applied to any part of these machines. Whether this was due to oversight or economy (?) can only be conjectured.

Would it not have been infinitely more optimistic and cheery generally, had these same machines been in the hands of the skilled mechanic, preparing them for whatever service they would ultimately have to render, rather than appearing as so many tombstones, and acting as a 100 per cent. efficient depressor on the few men that were left? Instead of four or five men, there was more than enough work for ten or a dozen bringing the machines into something like a respectable condition. None of them had been used on actual shell work, but all of them had been run by a double shift, which is invariably disastrous for the machines in a very short time. In view of this fact alone, would it not have been displaying a more optimistic spirit to have retained a few more of the men in order to make these very necessary repairs, and thus become prepared for any work that may crop up in the near future? Furthermore, these same machines would not only have then been in a more suitable condition for good work, but they would have increased very materially in value.

One has heard a lot of talk about the Government's short sightedness by not doing this, that or the other, also suggestions that something ought to be done in order to relieve the stress of numerous small shops. First of all, let us see who was really responsible for these small shops (not all by any means) coming into existence, and what was their motive. Was the motive one of patriotism, or was it because they had a keen suspicion that a considerable amount of pocket money could be made, and no risk? Did the Government ever know of their existence, and will it ever know they did exist?.

Had these shops relied upon the Government for contracts, it is a million to one that they would have been compelled to have pulled down their shingle inside forty-eight hours. The best the small shop could be expected to do was to either take a sub-contract from the larger shops, or else work upon special shell machinery, jigs, fixtures, cutters and the like.

Now all these demands have ceased, what then? Surely these small shop men were not so small minded as to think that the war was going to last for ever, though the way some have acted since the signing of the armistice, it would certainly suggest that they had received a bitter disappointment by the war ending so soon. One hears from every angle the question of what to manufacture, instead of what not to manufacture.

Upon reflection it must be clearly seen and freely admitted that there are really very few things that, once manufactured, cannot be sold. Of course, one does not wish to manufacture an inferior article, or, in fact, any article that would not be worth while, be it a machine tool, a household article or a toy. There are hundreds of articles that could be improved upon without infringing upon any patent rights, and as many more that could be manufactured with very little outlay on either equipment or stock.

Yet, the heads of many of these shops, and in many cases the owners themselves, are bemoaning the fact that there is nothing to do, which is just so much tommy rot. Surely these men do not expect a war has to be kept in progress in order that one may get a living. Now is the time more than any other that one should keep a stiff upper lip, as it were, and get particularly busy on some staple line of manufacture, and there are thousands. Then when the soldiers begin to pour into Canada they could be offered a remunerative position in many places, and thus relieve the Government somewhat of the big problem it will surely have to face. The toy industry has only been handled in a half-hearted way in Canada, the usual argument being that we cannot sell so cheaply as the foreigner, which is a question.

Automobile supplies offer another large field, likewise household utensils

Continued on page 716

MARKET DEVELOPMENTS

Pittsburgh Cuts the Price of Steel Products

Announcement Comes as a Surprise, as Such Action Was Not Anticipated Just Yet—Move Made as Concession to Head Off a Demand For Deeper Cuts at a Later Date?

THE announcement is made from Pittsburgh this week that prices at the mills there are being reduced before the period expires in which the Government controls prices. This action really has the effect of annulling Government control. The federal control was for the purpose of keeping prices from going past certain well-defined maximums, and the action of the mills in voluntarily going under these figures can be interpreted as marking the end of price control in the United States.

Indications also point to a similar course to some extent in Canada. This week steel plate is selling from the warehouse at 7c per pound, a reduction of 1 cent since last week. It has reached as high as 12 cents per pound, and it is on record that it even touched 15 cents during the war period, but that was before prices were controlled from Washington and Ottawa.

No announcement has yet been made as to what disposition will be made of the castings that are piled up around many of the machine shops that have been working on munitions orders. There are great piles of these. One Toronto shop that has 9.2 orders, has at least 50,000 of these blanks in its yards, and the chances are that they will be scrapped. Each of these castings weighs approximately 370 pounds in its rough state, so it will be seen that in this one place there will be 9,250 tons of material to be disposed of. This ought to be a great source of supply for the melters for some time. First operations on the machining of American shells have been stopped this week, and the business will be wound up about the 25th of the month. Some of the fuse contracts are still good, and they may be allowed to stand for some time.

Speedy action on the part of the Government in making readjustments in connection with contract cancellations would assist in removing traces of war from the trade as speedily as possible.

The scrap metal market is still in a poor condition. No sales are being made unless there is considerable urgency in the deal. Prices for material are very uncertain, and any quotation that is made is hardly indicative of the real strength of the market.

MONTREAL IS WAITING TO SEE WHAT THE OPEN MARKET WILL DO

Special to CANADIAN MACHINERY

MONTREAL, December 19, 1918. With the holiday season approaching, the quiet tone of all the markets is more than ever emphasized. It is anticipated that many changes will be effected shortly after the turn of the year and it is this possibility that influences the trade. Few are anxious to buy under the existing unsettled conditions, the consequence being that reconstruction is deferred in many cases. Plans are now being made to place most of the markets on an open basis, and it is this that puts the consumer in a reluctant mood. It is practically certain that some lines of steels and irons will go to a lower level, but with the high cost of production still a factor this appears to be uncertain. Copper producers intimate that a free market may mean higher prices.

Easier Market Coming

Just what the developments are to be in the steel situation after the turn of the year is at present undecided, but it is certain that existing conditions are not such as to throw a clear light on early future operations. That reduced prices are a natural outcome is generally conceded, but the extent of such decline is covered by the term moderate, which may apply in many ways. Dealers here are practically resting on their oars as they must abide in a large measure by the action of American producers. In all likelihood the market after the 1st of January will be an open one, but a guiding hand may be adopted to control what might otherwise result in a collapsing market. The situation here has few features, and buying is light. The possibility of lower prices is an influencing factor of present activity, and consumers are only covering their immediate requirements. In very few cases are dealers permitting cancellations of material and every effort is being made to keep stocks as low as possible. This is a good sign, and the effect will be to stimulate business when some adjustment, regarding a ruling for the coming quarter, has been made.

While deductions are contemplated, the situation here is relatively unchanged as dealers do not anticipate any pronounced development until after the holiday season.

Metals Quiet and Firm

The general metal market has been more or less influenced by the marking of time in the preliminary stage of readjustment, and with the various situations still under Government regulations, nothing of importance has developed. Copper is quiet, with buying confined to present needs, the knowledge that control may be removed or a new price set, prevents consumers from taking an interest in supplies for future requirements. Tin is in an undefined position with prices holding. Lower prices on lead had little effect on the market, and buying is not active. Other metals are unchanged at last week's quotation.

Supplies Moving Steadily

The developments so far since the termination of hostilities and the general cancellation of war contracts, have not been such as would indicate a return to machine tool activity on a large scale.

This does not mean that there is no market, as there is still considerable enquiry for various lines of standard tools, but that buying for future enterprise is almost nil. This, however, must be expected at the present time, owing to the coming holiday season and the uncertainty prevailing on all sides. Business here is not pronounced, nor is it very dull, but the recent pressure is no longer felt.

The supply demand is fairly steady, the bulk at present going to shipbuilding plants or firms manufacturing ship or engine equipment.

Scrap Very Quiet

It is not thought that the scrap market will show any activity until the turn of the year or until such time as the steel situation becomes more settled. The local market is in a stagnant state and dealers here report little or no business other than a light movement for immediate requirements. The quotations are nominal but unchanged, with the prospect for lower prices after the New Year's adjustment.

STEEL PLATE NOW AT THE 7c. MARK

Large Amount of Shell Castings Will Be Ready For the Scrap Pile Now.

TORONTO. — Machine tool dealers for the most part are trying to remove the traces of war from their business as rapidly as possible. This is impossible in some cases because readjustments have not yet been made, and there are a number of these following the cancellations that were made following the signing of the armistice.

Employment offices of several of the larger concerns in the city report that there are a number of men looking for work now, and that the hands leaving shell shops are not being absorbed as rapidly in other lines as they are being turned off from the shell plants.

A Big Scrap Pile

The closing down of munitions plants makes it quite certain that there is going to be a lot of steel left in this country that was intended to be turned into such shape that it could be shot toward the river Rhine. At one of the big Toronto plants where work has been going on on the 9.2 shell, CANADIAN MACHINERY was informed this morning that there would be about 50,000 forgings that would never get into the first operation. Each of these will weigh about 370 pounds. This means that there are some nine thousand and more tons of steel there that will have little value except for scrap. It will make nice material for some of the melters to secure.

Whether all the shells that have been machined since the cessation of the war will be secured or scrapped is another question. One firm is now piling large projectiles at the Exhibition grounds, Toronto, instead of sending them to shipping points as formerly. So far there has been a stack built up of some 15,000 shells there and it is being added to daily, this process continuing up until December 25.

Scrap Metal Trade

"We are sitting on the fence." That, in the words of a Toronto scrap metal dealer this morning, about sizes up the situation not only here but all over the continent. In fact there seem to be some places where there is not enough activity in sight to cause the dealers to climb up on the fence. Small sales are going through at prices considerably below the prices that have been and still are quoted. These sales have not yet become sufficiently numerous or significant to form the basis for a new set of prices. When a sale is made now there is more or less urgency in the deal. Either a dealer has an old contract that he is anxious to fill, or the seller has been stuck with a lot of material that he is very anxious to liquidate. Apart from these conditions there is no selling.

At one of the big shell shops this morning a bargain was made for two cars of copper turnings at 15¼c per pound. This is well below the level of trading values that have been recognized for some months past, and also well below the U.S. fixed price of 26½c for new metal. Even at that figure there is not a great chance for business, as the buyers are not certain where the market is going to find its new level when the price has been allowed to work out its own course free from control or regulation.

Plate Comes Down

At U.S. points this week announcement is made that there has been a revision downward of the selling prices of many lines of iron and steel, and this same tendency is working out in the quotations that have been made to the Canadian trade. Plate is one of the articles that forms a pretty fair barometer of trade in Canadian warehousing interests. When plate shows a tendency to come down it can be taken for granted that there will be a similar movement in other lines. This week prices on plate have backed down another cent per pound, to-day's quotation being 7 cents. For a short time this year plate sold from the warehouse at as high as 12 cents. After the War Trade Board at Ottawa came into existence that body refused to recognize anything over ten cents, and so it stayed at ten cents for a good many months. Immediately on the cessation of war the price began to slide, and has touched $9, 8 and $8.50 on the way to the $7 per hundred mark. If this figure represents anything approaching a final figure it will be seen that it is still far above the mark quoted at the American mills, which is a straight three cents for plate in most cases.

Making Readjustments

Many of the machine tool dealers feel that the governments can help matters considerably just now if they will make their adjustments quickly, and allow the dealers and all firms that have been engaged wholly or partially on war work to get back at once to regular lines. There are many firms turning from the munitions business that do not know for a certainty what lines they will develop, and for this reason they cannot place orders for equipment. The cost of securing the special equipment they may need is not going to deter them as much as making sure of the lines they are going to follow. Dealers are looking for a betterment in the machine tool demand when these firms have concluded their investigations and are prepared to turn definitely to something for domestic or foreign trade.

POINTS IN WEEK'S MARKETING NOTES

At one shell shop in Toronto which is still operating on American orders, it is estimated that there will be 50,000 castings that will never be taken into the machine shop. Each one of these will weigh about 370 pounds, so it will be seen that there will be well over nine thousand tons of steel scrap left at this one shop. The disposal of this material has not yet been decided upon.

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The manufacture of American shells in Canada will end about the 25th of December. First operations in machining will be cut off this week. One firm has about 15,000 of these machined shells stored at the Toronto Exhibition grounds, delivery having been suspended at shipping point for some weeks past.

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Employment offices report that there is an increasing number of applications made for work, both from skilled and unskilled sources.

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Sales of scrap copper were made at 15¼ cents per pound this week, which is well under the level at which the metal has sold for some time, and also well removed from the U.S. set price of 26½ cents per pound for copper ingots.

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Machine tool dealers urge that the Government should act quickly in the matter of making adjustments following cancellations on war work. The desire is to have all traces of war removed from trade as soon as possible.

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Pittsburg announces several reductions in the prices of iron and steel to become effective at once. The explanation is that these are concessions made with the idea of protecting the steel market against any decided run on price schedules. Plate is quoted at 3 cents per pound.

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Jobbers in Canadian points put the price of steel plate at $7 per hundred. This is a drop from varying prices, which have reached about as high as $12 per hundred during the year. Indications are that it may drop still farther here.

PITTSBURGH REPORTS THAT IRON AND STEEL PRICES COME DOWN

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., Dec. 19—The iron and steel industry is reducing prices, $3 a ton on pig iron, $4 on unfinished steel, except rods, and $4 to $6 per net ton on most finished steel products, wire being an exception.

While our previous reports have reflected an expectation that producers would make a strong effort to maintain existing prices, the present reductions do not run counter to that principle. The reductions are, in essence, an effort to maintain prices, slight concessions being made for the purpose of meeting the situation and reducing the tendency to cut prices deeply. The trade was disposed to maintain Government prices because it did not see that it could find a good stopping place in the decline that would have to come sooner or later. Means have been found, however, for establishing a slightly reduced level, and the question now is how long the reduced level will hold. The theory is that it will hold longer than the full Government prices would have held.

The new level is produced by the ingenious device of the general committee of the American Iron and Steel Institute preparing a schedule of reductions, to be submitted to the War Industries Board as a basis for Government prices for the first quarter, and upon the Board's refusal to consider the matter, announcing the schedule in the newspapers as representing the views of the trade. There is no doubt that when the schedule of reductions was prepared it was known that there was scarcely any possibility of the War Industries Board naming any prices to obtain after the present quarter.

Old and New Prices

The reductions are as follows: Pig iron, $3 per gross ton; Bessemer, $35.20 to $32.20; basic, $33 to $30; No. 2 foundry (1.75 to 2.25 per cent. silicon), $34 to $31; malleable, $34.50 to $31.50; forge, $33 to $30; unfinished steel, $4 per gross ton; billets, $47.50 to $43.50; sheet bars and small billets, $51 to $47; and slabs, $50 to $46; rods being unchanged at $57; plates, 3.25c to 3c., or $5 a net ton; shapes, 3c to 2.80c; bars, 2.90c to 2.70c; blue annealed sheets .10 gauge, 4.25c to 3.95c; black sheets .28 gauge, 5c to 4.70c; galvanized sheets, 28 gauge, 6.25c to 6.05c; tin plates, $7.75 to $7.35; standard steel pipe, three points or $6 a net ton, from 51 per cent. to 54 per cent. basing discount.

No change is made in wire products as the wire mills had complained that their costs were particularly high. Various steel products are to be reduced in proportion to the basic material to which they are cognate. How far this will be carried out remains to be seen. Thus if hoops and bands were reduced from 3.50c to 3.30c there would be a reduction of $4 a ton, the same as is made in bars, but hoops being a more finished product might perhaps be entitled to a larger reduction.

At this writing nearly all the steel makers have announced reduced prices in conformity with the schedule, but applying only on new sales for delivery after this month. The blast furnaces have shown an indisposition to reduce their asking prices at once, but, of course, will do so eventually. There is so little enquiry before them, except for practically spot shipments, that there is no particular occasion to reduce prices suddenly. So far as actual transactions are concerned the market is perhaps properly quotable at the old level, but undoubtedly a good buyer prepared to take a round tonnage could purchase at the reduced figures.

Bearing on Contracts.

The pig iron and steel producers are all insisting that the reductions do not apply on contracts, that they will expect customers to take out material at full contract prices. As to this the customers will doubtless have something to say and the producers will probably have afterthoughts. In previous market declines some contracts have stood, others have been revised. Pig iron contracts usually stand, as do contracts for unfinished steel. Finished steel for definite jobs of construction, such as shapes for buildings and bridges, plates for steel cars, line pipe for pipe lines, are ordinarily in the form of irrevocable contracts. Contracts with manufacturing consumers and jobbers have frequently been subject to revision. When occupying this attitude as to holding customers to contracts, producers do not like to be reminded of the fact that if their declared program had been carried out, of the reductions being recommended to the War Industries Board and the Board naming them as Government prices for the first quarter, the Government regulation would have required the revision of many contracts. According to the Government regulation promulgated December 28, 1917, and repeated at intervals afterwards, all contracts after that date had to be so written and interpreted that the invoice price should not be above the Government price at time of shipment. As the War Industries Board is not making the prices the producers are relieved of the regulation, but according to the appearance of things the producers desired the Board to name the reduced prices and it was the Board that refused to do so.

Buying Is Light

Price reductions never stimulate buying, at least at the outset, and the iron and steel market has been particularly quiet in the past week. There is fairly heavy pressure for deliveries of finished steel on some contracts, but only by consumers who can dispose of their finished products at once and encounter practically no risk by having material on their hands in a declining market. During the war steel was very scarce and upon its conclusion there is naturally considerable call for steel in certain quarters, but there is no well rounded out consumption of steel sufficient to engage the full capacity. Mills are, moreover, feeling cancellations of Government orders to a greater extent than in the first three or four weeks after the signing of the armistice.

The future of the iron and steel market depends upon the development of regular investment buying, through new buildings, bridges, factories, etc., being projected. The investors have more to wait for than a reduction in iron and steel prices, for in carrying out their projects they must buy other materials also, and they must wait for them to come down. It is clearly understood that one motive actuating the iron and steel producers to reduce prices promptly was that of setting a good example to sellers of other commodities, to induce them to reduce prices also. Then the labor situation must be improved before much work can be undertaken. Premiums for labor must disappear and men must be willing to put in a full day's work for a day's pay. These readjustments will require some time still, but there are many observers who think that within three months' time conditions will be such as to encourage investors to go ahead with new projects.

SCRAP MARKET STILL STAYS IN A VERY LISTLESS CONDITION

THE scrap metal market is in a listless condition.

Pittsburgh.—There is practically no demand for scrap from consumers, the market being wholly confined to the dealers, and in their case the only demand seems to be for small lots to finish up contracts which expire at the end of the year. Some of the shell blanks left on the hands of shell makers by cancellations of orders are beginning to reach the market as scrap. It is reported that the sheet steel market is plentifully supplied, and low phosphorous steel has been offered for as little as $32 a ton Prices are merely nominal in the scrap market, as there is practically no buying

Philadelphia.—The amount of business done in the scrap market is very little, prices of old material falling away generally during the last week. $25 a ton is now quoted for heavy melting steel delivered, and the various other grades are on a lower basis. The real level of prices cannot be determined, as there is a dearth of real transactions.

Cleveland.—The scrap iron interests here are looking forward hopefully to the new year for active trading to resume. It is thought probable that scrap iron will not drop as low in price as has been anticipated. The limited amount of buying that is being done just now is entirely confined to the dealers. There have been a number of shells turned on the market, which have been pierced but not machined, but even though they are better than the average melting steel, there is no demand from consumers. Melting steel is being offered at $28 with but few takers.

St. Louis.—A further drop in prices is anticipated here before the bottom is reached, as all the offers on the market are to sell, with no buyers in sight. Consumers generally are staying out of the market, and are in many cases cancelling orders for supplies. Government cancellations and foreign government business being cancelled is having its effect by leaving consumers with more scrap on their hands than they have use for. The railroads are in the market to sell scrap, and in the case of some of the roads, they are holding their stock of scrap back merely in order to avoid demoralizing prices still further. However, manufacturers of specialties who have been deprived of the ability to purchase raw material for so long, are now starting to produce, and this may have a steadying effect before long.

Chicago. — The scrap iron and steel market here is in a state of considerable weakness. The tendency is to wait till the question of price regulation has been definitely settled before making any advances on the part of the consumer. A large amount of tonnage is being cancelled, in most cases contracts made for delivery during preceding months and not yet shipped. A good deal of overbuying was resorted to early in the present quarter by steel manufacturers, they thinking that by making larger contracts they would get better deliveries. A decided effect in this country is being made by the export from Canada of turnings and other scrap from the munition plants of that country.

BUYERS OF PIG IRON WAITING FOR REMOVAL OF PRICE CONTROL

BUYERS of pig iron in the United States generally are looking for the result of the meetings of the American Iron and Steel Institute with the War Trade Board at Washington, before going into the market. The impression in the trade is that after January 1st next all Government control will cease, and leave a free market thereafter. There is a good deal of strength to the market owing to a large amount of next year's tonnage having been already contracted for. The conditions covering the United States are shown in the reports from the following leading points:

Pittsburgh.—There are plenty of enquiries for immediate deliveries, but for deliveries during the first quarter and half year are notably scarce. An enquiry for 12,000 tons was received recently, delivery to be made over the first half of next year, and a price of $40 was quoted, the deal being still in suspense. Consumers who are attempting to have unfilled portions of contracts annulled, which had been allotted to them for war purposes, are not meeting with success. They are being granted a suspension of shipments, but their obligation to take all the steel allotted to them still holds.

Chicago.—The market is practically moribund here, there being no buying at present. Melters are even refusing offers of consignment of iron for immediate use. Inquiries for export are increasing, and some orders have been booked for shipment to Japan and Italy. The matter of price fixing for the first and second quarters of next year once disposed of the market will become active, as melters who have not their required tonnage on hand will be seeking it.

Philadelphia.—Sales in the eastern district have been dropping off during the last week, only a few small lots having been sold for immediate and first quarter delivery. Although contract cancellations are in demand furnaces are sticking to their position, and are refusing to make any cancellations where the contracts are binding. Owing to a large number of complaints being made by consumers about the present differential on manganese content, in some cases furnaces are waiving the differential. This is only in cases where the manganese content is low.

Buffalo.—Opinion here is that prices are likely to remain at their present level for some time to come. It is thought that some of the furnaces remote from the Great Lakes will have to shut down, as they are said to be making not more than a dollar a ton on their product. No cancellations are being allowed by furnaces here, but in some cases adjustments have been made, such as changing delivery dates, or substitutions made. The Canadian price of pig iron is from $6 to $8 above the Buffalo price. It is the general opinion that after the first of the year there will be an open market.

Birmingham.—There are quite a few offers being made by foreign buyers, Japan and Italy in particular, for large tonnages. Some small cancellations have been received in this territory, but these have been covered by domestic consumers buying small lots. The slow output at coal and ore mines, and the same conditions at limestone and dolomite quarries is keeping back production here, no improvement being shown in this direction.

St. Louis.—The situation here is adjusting itself in a manner which is surprising the most optimistic. Cancellations are being strictly forbidden by southern furnace interests, who recommend their purchasers to dispose of their surplus by resale, which method they believe will tend to keep prices firmer than if the melters disposed of the stock themselves. There is a large demand through this territory for pig iron from stovemakers, etc., who have been unable to get pig iron for quite a long time, and the demand for finished articles is enormous. It is believed this will keep foundries busy till well into 1919.

Cleveland. — Large sales have been made through the week, in the form of allocations placed through the committee on pig iron ore and lake transportation through this city. The quantities called for were from 25,000 to 30,000 tons of foundry iron for delivery at points on the Pacific Coast, and immediate shipment was requested. This was all for Japanese interests. Inquiries for malleable and foundry iron are fairly numerous, one of them being for 5,000 tons for the first half of the year. There is a large requirement for the first half of the year for the automobile trade, but they are expected to go very cautiously. Contracts entered into formally are being refused cancellation.

THE TRAINING OF FOREMEN
By D. STREET

One of three methods is usually adopted by firms when choosing a foreman—the position is advertised, a nominee of the retiring foreman is promoted, or advancement is by seniority. To promote anyone to a responsible position because of long service is not wise, as, although a man may be an excellent craftsman, and of good character, unless he has certain natural attributes, he will not make an efficient foreman; nor is it wise to accept the advice of a retiring foreman, because he may be actuated primarily by friendship, and with the best intention his opinion will probably be biassed. Advertisement appears to be the fairest and wisest way, although even then there is no guarantee that the best man will be chosen. It is surprising that we have no recognized way of training ambitious craftsmen who aspire to foremanships. There are essential virtues of a good virtue that cannot be imparted, such as tact and firmness, but they can be greatly strengthened, and many of the qualities that make a successful foreman can be taught. It is as important to have highly qualified men as foreman in our workshops as it is to have competent non-commissioned officers in an army. They have, to a great extent, a direct influence on increasing the productivity of both men and machines, and, on the other hand, if they are unsuitable, they are a source of continual irritation among the workmen, which generally ends in strikes. A great many strikes could be traced to the pin-pricking policy of a foreman engendering discontent. There are very few men who, after holding a subordinate position for many years, and never having studied what makes the capable leader, can withstand the temptation of unduly asserting themselves when placed in a position of authority. The problem is to a considerable degree psychological, and a proof that no great change can safely be effected in a man's position of the incompetent foreman is that he exerts an influence on the apprentices which affects their whole career. Anyone who has had experience of workshop life knows that the character and conduct of the boys are moulded by those around them. It is during the impressionable years of the teens that character is formed, and a good foreman, by surrounding himself with good craftsmen, may do a very real service to the state.

The appointment of a new foreman is always experimental, but very often, for a considerable time after the change, the output of the department is reduced, and there is a great deal of dislocation that could be avoided. The promoted man is only an apprentice in leadership, and has to become proficient through making blunders and gaining experience.

The ideal foreman has business abilities and an irreproachable character, a first-class technical education, and a high degree of skill as a craftsman. There are, however, few ideal foremen and very many employers ignore the point of character, and either show a preference for a skilled man with small business ability, or a good business man and organizer, who is an indifferent craftsman. There is no reason why the average foreman should not approach the ideal, and it is regrettable that our technical institutes do not have courses of training suitable for ambitious young mechanics who aspire to become foremen. It is usually the best class of lads and young men who attend technical classes, and although the diploma which they may receive is a guarantee of years of application and a knowledge of principles which is invaluable, the man may be still unsuitable for a foremanship. It would appear to be desirable either to have a course for a supplementary diploma on "Foremanship," or to include lectures on organizing and the best way of dealing with men in the ordinary diploma course. Whatever department of life is considered, it is not always the most brilliant scholars who are the best leaders, or who make an enduring mark, but those men who have the inherent or acquired qualities which enable them to restrain wisely, and, when commanding, to win respect. It is a very great advantage for the foreman to be able to express himself, and to explain in a lucid way what he wants, and the best way of doing it. To convey one's ideas to others is largely a matter of education, as clearness of expression is not altogether a gift. It may be contended that the difficulty of procuring good lecturers would be great, but there are men in every large technical school eminently qualified to give instruction in organization. It would be a wise procedure for large firms to run courses of lectures for their foremen during the winter months, and such lectures could be delivered by outside scholars and by managers who have had a wide experience.

The labor situation in Northern Ontario is already showing symptoms of improvement, according to the "Advance." Several hundred men have come into the Porcupine during the last few weeks, and more are coming every day.

WHAT ARE CHANCES FOR BRAZIL'S TRADE?

Nearly all the electrical machinery now supplied to Brazil comes from the United States, although, before the war, a good deal was imported from Germany. The reason for Great Britain's poor showing can only be that our manufacturers have not sufficiently pushed the sale through suitable agents. The British Chamber of Commerce of Sao Paulo will be glad to place British exporters of electrical machinery, or any other goods, in touch with the right class of agents.

Files

The Americans have captured the file trade. Some years ago the files were supplied from Great Britain, but the Germans took the trade away in spite of the poor quality of their goods. The Americans followed the lead of the Germans, but produced a better quality file, with better packing, and captured the trade. Customs duties on files are paid according to weight; consequently the demand is for what is now known as "light weight" files. The Americans pack their files in neat cardboard boxes of half-dozen, dozen or more, depending on the sizes, whereas British makers continue to wrap their files in paper parcels in the old-fashioned manner, which parcels get torn in transit, the ends of the files stick out, rust and generally are less easy to handle.

AN INTERESTING JUDGMENT

A case of interest to all those who have occasion to entrust repairs to an engineering firm, without making a definite contract, was decided at Montreal last week, by Mr. Justice McLennan, sitting in the Admiralty Court. This was an appeal taken by the owners of the "Susquehanna" from a judgment in favor of the Canadian Vickers, for the cost of repairs made to this vessel. The amount claimed was $52,983.34, and the appeal judge reduced this amount by $17,000. The repairing firm's statement showed that material plus 5% handling charges came to $6,665.43, and the labor to $14,905.73, and the total claim amounted to $53,541.21.

After pointing out items charged to "overhead expense" and one of 47.3% net profit, the judge stated that the burden was on the plaintiff to establish that its account represented the fair market value of the repairs. If the cost were definitely ascertained a net profit of 12½% would have been fair and reasonable. If the average of the overhead charges to others as just stated was added to the charges for labor, and a net profit of 12½% added to cost of material, labor and overhead so ascertained, the total would be under $35,000, which was the amount estimated approximately by the plaintiff's works manager, and manager before the work was undertaken. The judgment was in favor of the appellants for $35,080.

It is unusual to find a company of the standing of the Canadian Vickers making charges which are practically exorbitant, but the judgment given in this case should serve as a useful example to other firms who are sometimes tempted to extract undue profits from clients who have no fixed contract made for the work to be done.

AIR-COMPRESSOR TROUBLES

Some time ago a small belt-driven vertical air-compressor was installed in a certain boiler-room where there was considerable dust, due to handling coal and ashes. It was necessary to extend the 1½-in. inlet pipe outside of the building. As the unloader was of a sensitive construction, and as the least bit of dirt would make the pistons stick, causing poor regulation, considerable power was wasted because of the safety valve on the receiver releasing continually.

It was desired to connect the pipe as direct to the compressor and with as few fittings as possible, which located the end of the suction pipe between the eaves of three roofs. To keep it free from water and other obstructions, a hood was made from 6-in. galvanized sheet metal pipe with a 2-in. galvanized pipe nipple. These parts were all taken from used material found about the factory. This arrangement has worked satisfactorily for about a year, and it has never been necessary to clean out to unload, nor has there been any trouble from poor regulation.—M. E.

THE POSITION OF THE SMALL SHOP

Continued from page 711

and builders' supplies, the manufacture of the latter having been at a standstill practically since the commencement of the war. Then again, what condition is eighty per cent. of the machine tools in Canada in to-day? Little better than scrap; that is, those tools that have been employed upon munitions and the like. In order to bring them to within fifty per cent. of what they formerly were means a lot of work, and it will cost money, but have they not earned money? Good money, too. If these "pinheads" think for one moment that because the war has ended, that they must now jump their traces, and do ultimately get out of business, then business has certainly profited greatly by the termination of the war, inasmuch as it has got rid of these "pinheads," who, having the courage of a slacker, has lived up to the old, old adage, "He who fights and runs away, lives to fight another day."

TYKE.

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	$32 75	
Lake Superior, charcoal, Chicago	37 50	
Standard low phos., Philadelphia	.....	
Bessemer, Pittsburgh	37 25	
Basic, Valley furnace	33 40	
Government prices.		
	Montreal	Toronto
Hamilton		.....
Victoria		50 00

IRON AND STEEL

Per lb. to Large Buyers.	Cents
Steel bars, base, Toronto	4 90
Steel bars, base, Toronto	5 00
Steel bars, 2 in. to 4 in base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	4 55
Steel bars, base, Montreal	5 05
Reinforcing bars, base	4 50
Steel hoops	7 50
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Brand steel, No. 10 gauge, base	5 05
Chequered floor plate, 3-16 in.	12 20
Chequered floor plate, ¼ in.	12 00
Staybolt iron	11 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	*2 90
Tank plates, Pittsburgh	*3 25
Structural shapes, Pittsburgh	*3 00
Steel hoops, Pittsburgh	*3 50
F.O.B., Toronto Warehouse	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	4 10
Structural shapes	4 20
Plates	4 45

*Government prices.

FREIGHT RATES

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	29	39½
St. John, N.B.	47½	63
Halifax	49	64½
Toronto	23½	27½
Guelph	23½	27½
London	23½	27½
Windsor	23½	27½
Winnipeg	81	106½

METALS

Lake copper	$ 31 00	$ 29 50
Electro copper	31 00	29 50
Castings, copper	28 50	28 50
Tin	83 00	88 00
Spelter	10 50	11 00
Lead	9 50	10 00
Antimony	12 00	16 00
Aluminum	46 00	50 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 8 00	$ 8 00
Plates, 3-16 in.	8 50	8 40

WROUGHT PIPE

Price List No. 37

Standard Buttweld

Per 100 feet	Black	Galvanized
⅛ in.	$ 6 00	$ 8 00
¼ in.	5 22	7 35
⅜ in.	5 22	7 35
½ in.	6 63	8 20
¾ in.	8 40	10 52
1 in.	12 41	15 56
1¼ in.	16 79	21 05
1½ in.	20 08	25 16
2 in.	27 01	33 86
2½ in.	43 29	54 11
3 in.	56 61	70 76
3½ in.	71 76	88 78
4 in.	85 02	105 19

Standard Lapweld

2 in.	31 82	38 30
2½ in.	47 97	58 21
3 in.	52 73	76 12
3½ in.	78 20	96 14
4 in.	92 65	114 00
4½ in.	1 12	1 37
5 in.	1 30	1 59
6 in.	1 69	2 06
7 in.	2 19	2 68
8L in.	2 30	2 81
8 in.	2 65	3 24
9 in.	3 17	3 88
10L in.	2 94	3 60
10 in.	3 79	4 64

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, 45%.
4½" and larger, 40%
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$15 00	$20 00
Copper, crucible	18 50	24 50
Copper, heavy	18 50	24 50
Copper, wire	18 50	24 00
No. 1 machine composition	19 00	22 00
New brass cuttings	10 00	15 50
Red brass turnings	13 00	18 00
Yellow brass turnings	9 00	13 00
Light brass	7 00	9 50
Medium brass	9 00	12 00
Heavy melting steel	20 00	22 00
Shell turnings	9 00	12 00
Boiler plate	21 00	20 00
Axles, wrought iron	32 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	30 00	33 00
Malleable scrap	25 00	20 00
Pipe wrought	18 00	17 00
Car wheels	38 00	30 00
Steel axles	34 00	35 00
Mach. shop turnings	9 00	8 50
Stove plate	22 00	19 00
Cast boring	11 00	12 00
Scrap zinc	6 50	6 50
Heavy lead	6 00	8 00
Tea lead	5 50	5 75
Aluminum	16 00	20 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	10
Carriage bolts, 7-16 and up	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 20
Elevator bolts	5
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less	10
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	add 20
Machine screws, o. and fil. hd brass	add 25
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 plus	30
Burrs only, list plus	50
Iron rivets and burrs	25
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R., bronze	25

MILLED PRODUCTS

	Per Cent.
Set screws	25
Sq. & Hex. Head Cap Screws	20
Rd. & Fil. Head Cap Screws	net
Flat But. Hd. Cap Screws	plus net
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in.	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	plus 10
Studs	net
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add 7 00

BILLETS

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 25	$5 30
Cut nails	5 70	5 65
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 41
Plumbers' oakum, per lb.	8½
Packing, square braided	0 34
Packing, No. 1 Italian	0 40
Packing, No. 2 Italian	0 32
Pure Manila rope	0 39
British Manila rope	0 33
New Zealand hemp	0 33
Transmission rope, Manila	0 45
Cotton rope, ¼-in. and up	72½

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Lead wool, per lb.	0 16
Putty, 100-lb. drums	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	0 95
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 03
Linseed oil, raw, single bbls.	1 95
Linseed oil, boiled, single bbls.	1 98
Plaster of Paris, per bbl.	3 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 20
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 06
Rosin "G." per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 25

CARBON DRILLS AND REAMERS

	Per Cent.
S.S. drills, wire sizes up to 52	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	40
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	net
Drills and countersinks...list plus	40
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	75
High speed cutters, list plus	40

COLD ROLLED SHAFTING

At mill	list plus 40%
At warehouse	list plus 60%

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..	$ 8 00	$ 8 00
Sheets, black, No. 10..	10 00	8 50
Canada plates, dull, 52 sheets	9 00	9 15
Can. plates, all bright.	9 50	10 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...	.....	10 70
Premier, 10¾ oz.	.....	11 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS.

	Per cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	32½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$36 00	$.....
1¼ in.	40 00	.....
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.	.....	58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 ft., Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	18
Palacine	21
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	49½
Cylinder oil, Acme	39½
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	13½

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
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	3 25
Polishing wheels, bull-neck..	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices Per Lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS.

Brass rods, base ½ in. to 1 in. rod..	0 38
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE.

White.			Cts. per lb.
XXX Extra..	21	Atlas	18½
Peerless	21	X Empire	17¼
Grand	19¾	Ideal	17¼
Superior	19¾	X press	16
X L C R	18½		

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	57 00	45 00
Braziers,' in sheets, 6x4 base	45 00	44 00

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$13 25	$13 25
Sheets, 3½ lbs. sq. ft.	13 25	13 25
Sheets, 4 to 6 lbs. sq. ft.	12 50	12 50

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

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	...
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

OPEN HEARTH BLACK STEEL SHEETS

One Pass Cold Rolled and Box Annealed

Quality

Service

THE STEEL COMPANY OF CANADA LIMITED

STELCO

Steel sheets bearing this trade-mark are equal, if not superior, to any produced on this continent.

They are the product of a Canadian mill---produced by Canadian workmen.

Submit specifications covering your requirements---and quotation will be promptly furnished.

THE STEEL COMPANY OF CANADA
LIMITED

Hamilton **Montreal**

Steel Grip

Gloves and Mittens

No. 605
$10.20 per doz. pairs (or all lefts or rights)

No. 674
$10.20 per doz. pairs

No. 680—Reversible Gauntlet Mitten. Can be worn on either hand. Price, $10.80 per dozen pairs (24 mittens).

Give so much extra **wear** that they're the most economical gloves and mittens you can buy.

For sandblasters, shipbuilders, pig iron handlers, chain handlers, scrap handlers, smelters, miners, grinders, chippers, etc.

Steel-Grip Industrial Gloves and Mittens give this **extra** wear because of their patented Steel-Grip reinforcement of palm, fingers and thumb, and steel-sewed seams.

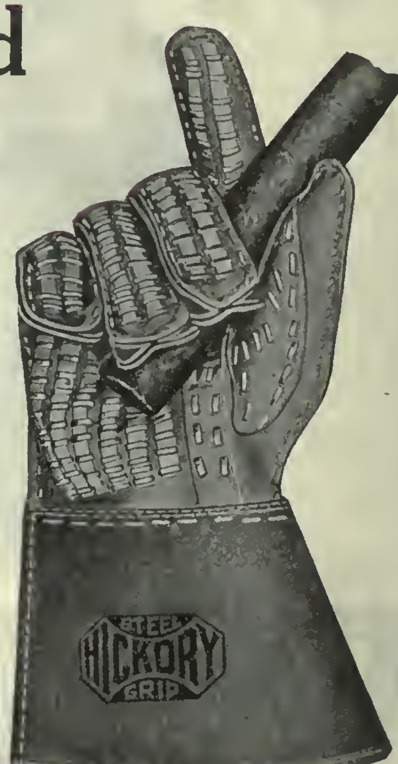
And this patented Steel-Grip reinforcing does not interfere with flexibility or comfort.

It **does** insure a longer life for gloves and mittens.

It **does** insure complete protection for the hands of workmen.

The steel sewing makes the gloves positively rip-proof.

These are the strong points of Steel-Grip Gloves and Mittens. See how well they work out in actual use to the advantage of yourself and your men.



A few users in Canada and Great Britain:

American Cyanamid Co.
Taylor-Forbes, Ltd. (Shell Dept.)
Crowe's Iron Works
Crown Cork & Seal Co.
The Steel Equipment Co.
Metal Drawing Co., Ltd.
Nicholson File Co.
The William Kennedy & Sons, Ltd.
The Williams Mfg. Co., Ltd. (Munitions Dept.)

England—
Agent: R. E. Boulton, Leigh, Westbury, Wilts.

SOLE MANUFACTURERS:

HICKORY STEEL-GRIP GLOVE CO.
INC.
Box T-6, CHICAGO, ILLINOIS

BRIDGEFORD

Meeting Service Conditions

In the Cleveland, Ohio, shops of the Erie R. R. in which these photographs were taken, service conditions demand the utmost despatch in retruing car axle journals. To handle necessarily heavy production with economy and efficiency, demands an axle lathe that will, day in and day out, stand up under the conditions imposed.

For 11 Years the

Bridgeford Heavy Axle Lathe

installed in these shops has faithfully kept up its maximum production with only the replacement of a set screw in the gear box. Averaging between 25 and 30 axles a day speaks for itself.

And Here Is the Proof:

	Min. Sec.
1. Setting up	:27
2. Turning collars	2:10
3. Rough turning	6:14
4. Finishing cut	4:20
5. Rolling	4:18
6. Polishing	2:05
7. Taking down	:29
Total	20:03

While necessarily the human element enters into production, the fact still remains that the design and construction of the lathe is responsible for the operator obtaining the production. This is because it is designed and constructed by lathe specialists who have an intimate knowledge of railway requirements and axle turning problems. Why not put *your* axle turning problems up to men who *know?*

Bridgeford Machine Tool Works

161 Winton Road Rochester, N.Y., U.S.A.

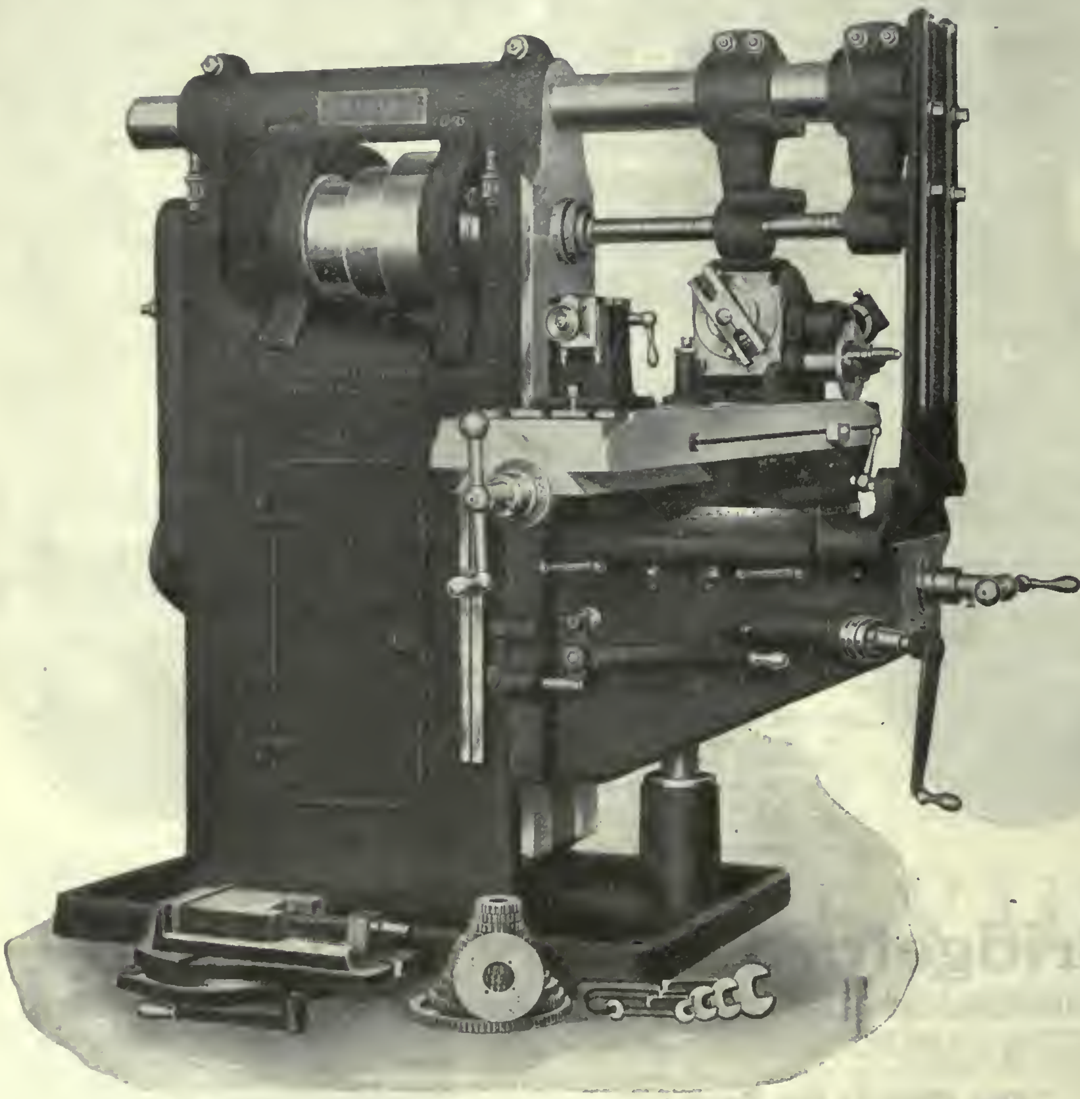
HEAVY ENGINE LATHES HEAVY AXLE LATHES

The Ford-Smith Machine Company

FORD-SMITH MILLERS

PLAIN AND UNIVERSAL

No. 2 Plain	No. 2 Universal	No. 3 Plain	No. 3 Universal
24" x 19" x 7½"	25" x 17" x 8"	34" x 20" x 10"	30" x 19" x 10"



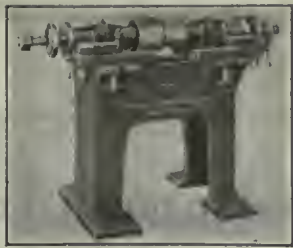
Manufacturing Efficiency and Economy

With Peace in sight the Manufacturer's attention turns to new conditions. In the keen competition about to begin both for home and export business only the efficiently equipped and economically run shops will succeed. The use of Ford-Smith Millers for accurate, general work, and quantity manufacturing will help you to the desired results.
Get in touch with us. Our service is at your disposal.

The Ford-Smith Machine Co., Ltd.

HAMILTON, ONTARIO, CANADA

Light Type Floor Grinder



Heavy Type Floor Grinder

Plow Grinder

Water Tool Grinder

Grinding and Polishing Equipment

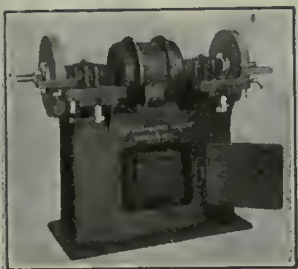
We illustrate here a few of our Grinding and Polishing machines. Possibly no other machine process offers such possibilities as the grinder. We build a wide line for **general** and **special** work. Shops taking up new lines of work, or speeding up present production, cutting down costs of manufacture, will do well to consider **grinding processes.** We have a wide experience which is at your service.

Write us. We can help solve your problems.

The Ford-Smith Machine Co.

LIMITED

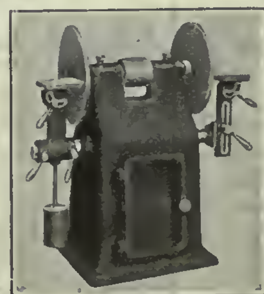
HAMILTON, CANADA



Motor-Driven Grinder

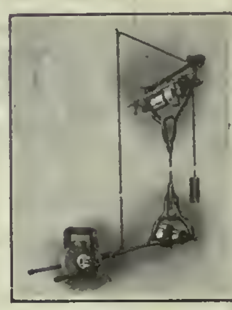
Buffing and Polishing Machine

Heavy Type Polisher



Disc Grinder

30″ Double End Grinder



Swing Grinder

SaBeN ExTrA
HIGH SPEED STEEL

The Highest Achievement of British Tool Steel Metallurgy.

SABEN

H-A-DRURY COMPANY LIMITED
STEEL

MONTREAL TORONTO NEW YORK

THE ST. LAWRENCE WELDING COMPANY, LIMITED
MONTREAL, P.Q.
A. M. BARRY, Mgr.

Office and Works:
138-140 Inspector Street
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HALIFAX, N.S.

CONSULTING ENGINEERS on all kinds of welding. Breakdown repairs handled at once, just 'phone us and we will be on the job by next train.

OXY-ACETYLENE WELDING of heavy cast iron frames, cylinders, gears, water wheels, etc.

STEEL, any kind of welding on parts of large or small machines, tanks, digesters, boilers, shafts, brackets, etc.

Can be welded in place when necessary.

ELECTRIC WELDING on boilers, digesters, leaking tanks, etc.

MARINE REPAIRS undertaken by our Marine Welding Tug which is equipped with Electric and Oxy-Acetylene Welding Apparatus with Compressed Air Plant complete.

OXY-ACETYLENE CUTTING of any kind of steel construction.

PORTABLE WELDING APPARATUS of all kinds with trained operators always available to repair your breakdown at once.

THERMIT WELDING on all classes of work is a special feature of present activities.

Manufacturers of Steel Tanks, Air Receivers, Welded Tanks, etc.; Electric Welders, Oxy-Acetylene Welders, Boiler Repairs, Lead Burning and Thermit Welding.

If You Need a
POWER HAMMER

of uncommon strength throughout — a hammer constructed to deliver work of surpassing quality in great quantity, and to keep everlastingly at it—

You Need Jardine's

Note a few particulars:

Hammer slide is a steel casting; so is the ram, and connecting bolts for the ram are machined from solid steel bar.

Hammer and anvil dies of properly tempered, highest grade tool steel are held in machine seats by tapered keys in the ram and anvil block, so there's no need to put taper on the dies.

Jardine's Canadian Giant Power Hammer has never failed.

Write for Catalog

A. B. JARDINE & CO.
Limited
Hespeler, Ont., Canada

LINK-BELT

FOR EVERY PURPOSE

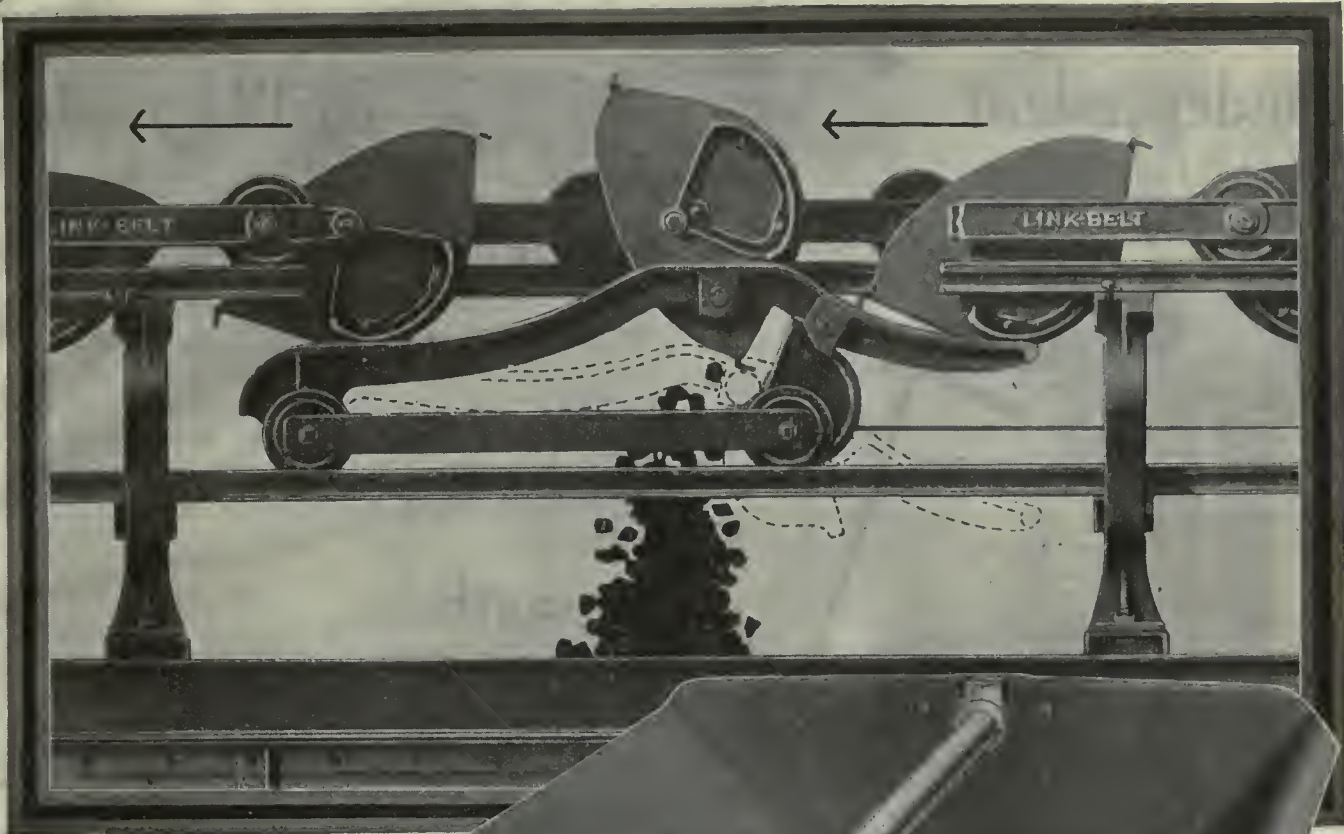
Whether your problem is one of power transmission, elevating or conveying, we have a type of Link-Belt especially designed for the purpose.

And when we say "especially designed," we mean it. For our engineers have spent years in the study of the peculiar conditions and requirements which various industries place upon Link-Belt. Each type has been designed not with the thought of how cheaply it can be made, but how perfectly it can serve its purpose. We show a few types of Link-Belt above. Our catalog shows many others. Send for a copy.

CANADIAN LINK-BELT COMPANY, LTD.

265 West Wellington St., Toronto

MADE AND CARRIED IN STOCK IN CANADA



Detail of Bucket

Upper Driving Corner

Elevates, Conveys and Automatically Dumps Coal, Ashes, etc.

THE Peck Carrier represents positively the last word in coal and ash handling equipment. The coal is not scraped but **carried** in overlapping, pivoted buckets, from the cars to the bunkers over the boilers.

The elevating, conveying and automatic dumping of the coal is all accomplished by one piece of equipment. There are no transfers needed. The buckets are supported on rollers. Friction is largely eliminated and power required is reduced to a minimum. Operates silently and without vibration.

The Peck Carrier is also used for the handling of cement, crushed stone, gravel, etc. Catalog mailed on request.

CANADIAN LINK-BELT CO., LIMITED
265 W. WELLINGTON ST. TORONTO

LINK-BELT
PECK CARRIER SYSTEM

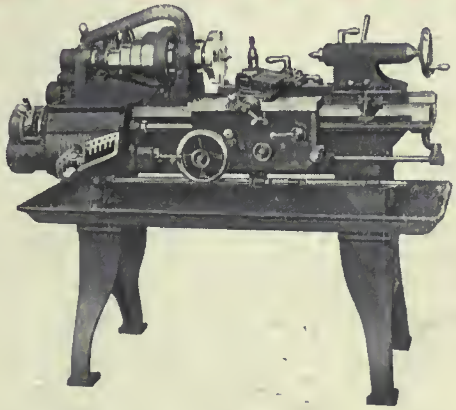
WILLIAMS & WILSON, LTD

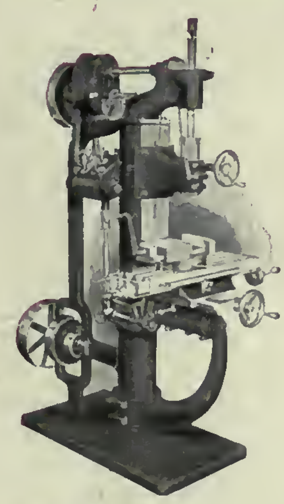
Cable Address "Willwills"

Montreal, P.Q.

Established 1891

Tool Room Machinery

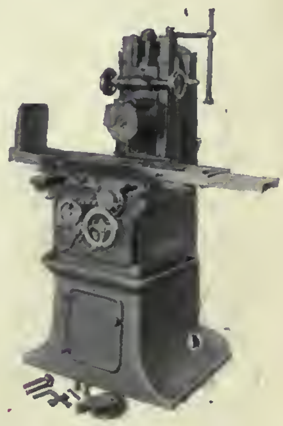




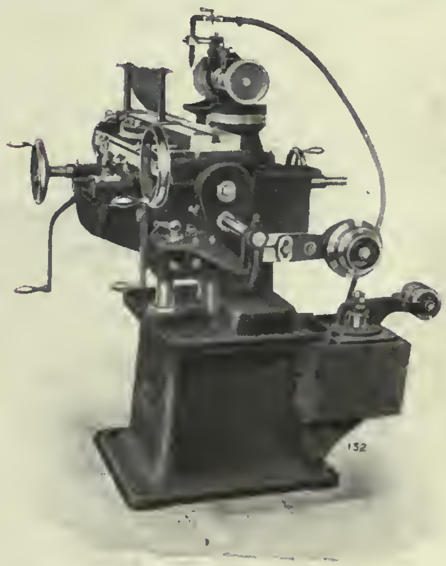
For those interested in advanced methods of Modern Tool Room Equipment

we have machines of the highest grade and efficiency for every description.

Let us give you full particulars and quotations. Write to us to-day.



Every Machine the Essence of Quality.



Our Lines ARE the Best.

We Stand Behind Every Machine We Sell.

WILLIAMS & WILSON, LTD

Cable Address "Willwills"

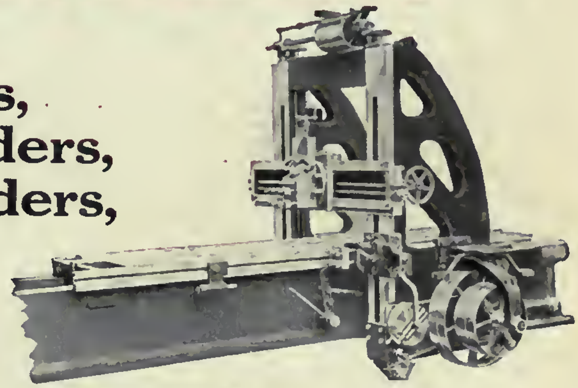
Montreal, P.Q.

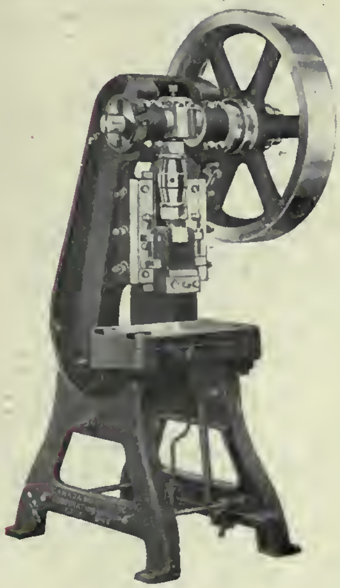
Established 1891

Iron Working Machinery

For

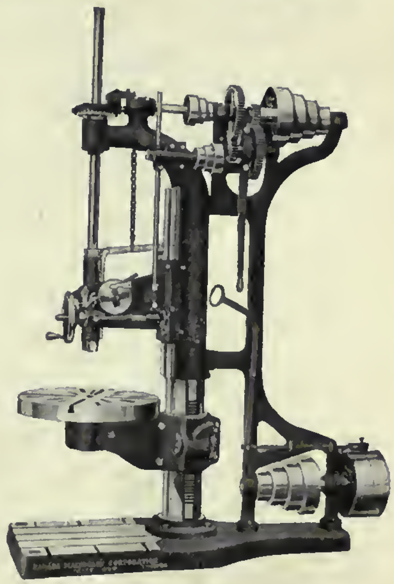
Railroads,
Shipbuilders,
Car Builders,
and
General
Machine
Shops, etc.

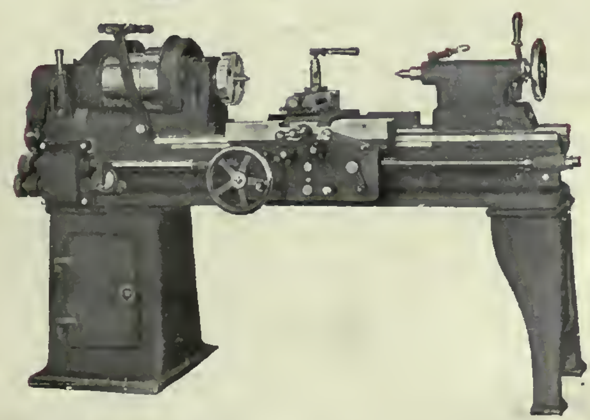


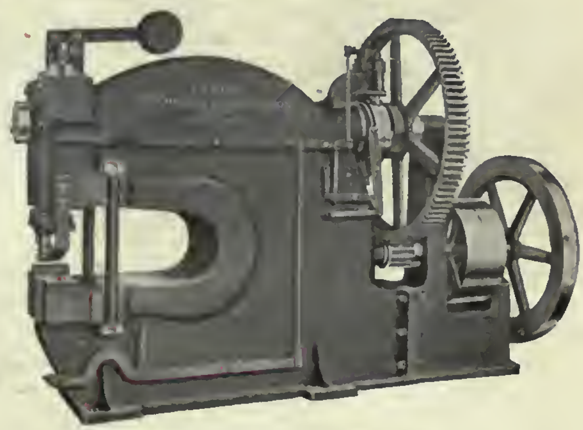


Send us a list of your requirements and we will gladly give you prices and deliveries on:

Lathes, Planers, Shapers, Milling Machines, Grinders, Radial Drills, Drill Presses, Boring Mills, Grinders, Turret Lathes, Keyseaters, Screw Machines, Bolt Cutters, Slotters, Pipe Machines, Punching and Shearing Machines, etc., etc.







Williams & Wilson, Ltd.—*Where the Best in Service Meets the Best in Machinery*

There is a

SADLER & HAWORTH

BELTING

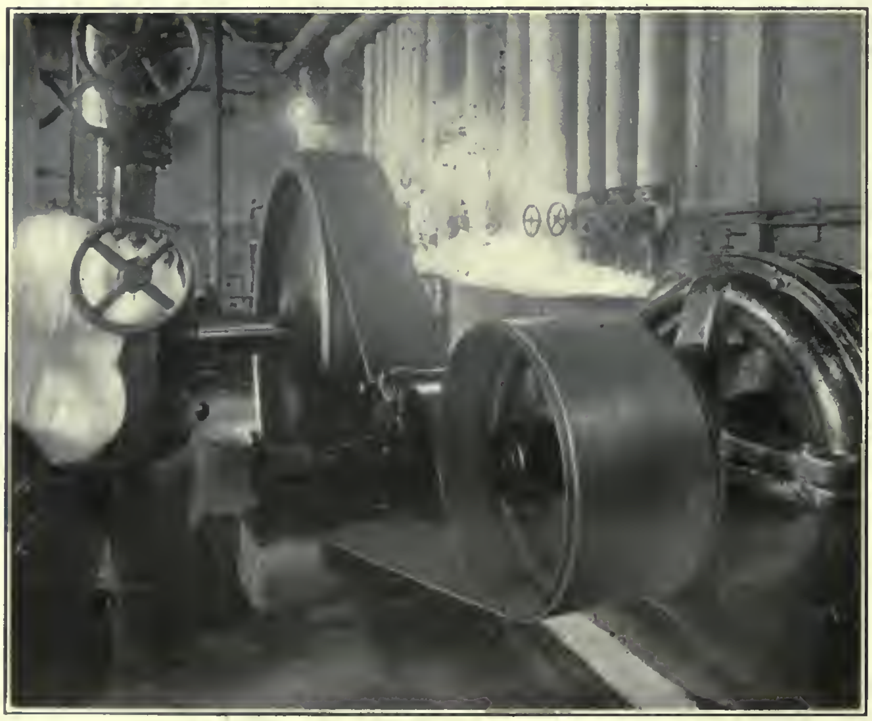
for use under every condition

SADLER & HAWORTH Belting is high quality belting.

Quality belting ensures you the least slippage, least breakage, takes up all the power and delivers all the power.

When Sadler & Haworth Belting feeds the power to your plant you are keeping transmission cost at a minimum.

Tell us your requirements. We'll be glad to furnish information and price of the belt that will best meet your needs.



A Sadler & Haworth Belt in the Matthews-Blackwell Plant at Montreal.

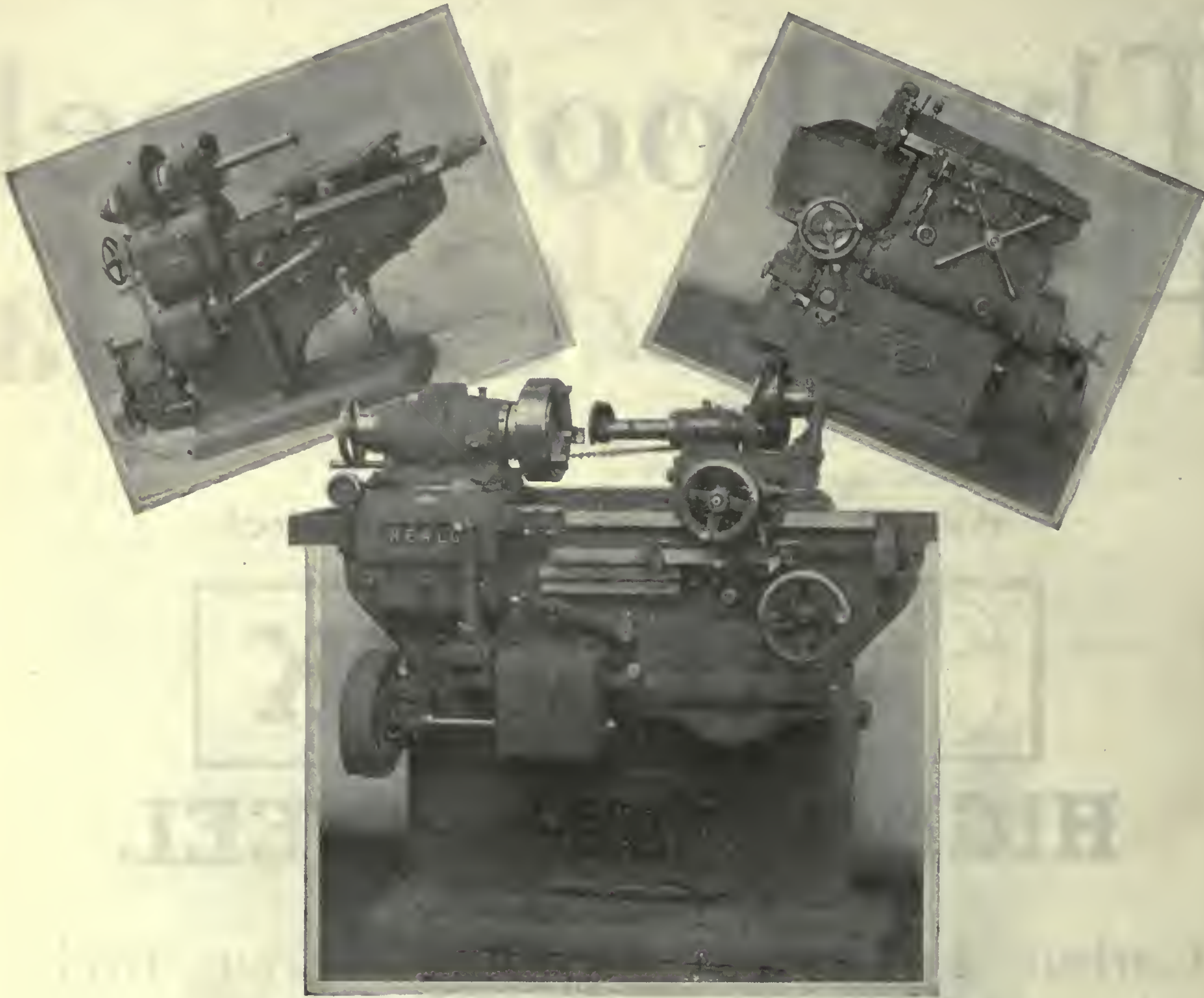
Illustration shows a S.&H. Belt connecting a 50-ton Ice Machine to 200 H.P. Canadian General Electric Motor. This unit has been in continuous operation since the middle of May. Belt is 17 inches wide, double "Climax" waterproof. Belt speed 5,652 ft. per minute.

SADLER & HAWORTH

Tanners and Manufacturers of Oak Leather Belting

511 William St., Montreal, P.Q.

Toronto, Ontario—38 Wellington St. E.; Winnipeg, Manitoba—Galt Building; Vancouver, B.C.—560 Beatty Street; St. John, N.B.—149 Prince William St.



INTERNAL AND SURFACE GRINDING

If you do surface or internal grinding one of these three will handle your work to best advantage.

The CYLINDER GRINDER will take care of all work that cannot be rotated to advantage, such as two, four or six cylinders en bloc, and awkward large sizes castings of any material.

The INTERNAL GRINDER produces absolutely accurate holes, either straight or taper, in hardened steel, iron or bronze. It is ideal on bushings, gears, collars, ball bearing races and a thousand other parts, where an accuracy and production are essential.

The SURFACE GRINDER delivers at a commercial rate a mirror finish on keys, rings, cutters, dies, discs, collars; in fact any shaped part whose size is within the capacity of the chuck.

Send for a Complete Folder Catalog.

The Heald Machine Company

WORCESTER, MASS., U.S.A.

6 ways you'll profit by introducing

DENNISTEEL

MADE IN CANADA

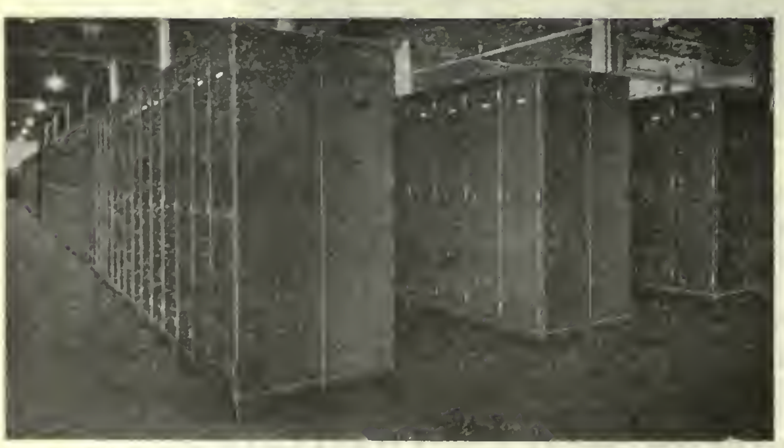
Lockers, Cabinets and Shelving

DENNISTEEL Material Cabinet. Saves costly parts and tools from damage. Saves men's time hunting for articles needed. Keeps your expensive stock safe from pilferers.

The day you begin to use DENNISTEEL Equipment you take positive action in the direction of

1. Fire Prevention
2. Increased Efficiency
3. Time Saving
4. Space Saving
5. Stock Saving
6. Money Saving

DENNISTEEL Shelving (standardized). Takes proper care of stock, preventing careless handling. 25% more storage space than wood shelves. Makes stock-taking simple. Adjustable to requirements. Will carry heaviest loads. Reasonable in cost and FIREPROOF. Ask for special shelving folder.



DENNISTEEL Wardrobe Lockers represent the highest type available. They cost a trifle more than others, but ultimate cost is less. Used by leading Canadian firms and corporations, because they stand up in service. Write for three-color folder on lockers.

DENNISTEEL equipment is used by all railroads and leading factories and industrial plants throughout Canada. DENNISTEEL is standard—not the cheapest but the best—and this applies to design, material, construction, finish and durability.

DENNISTEEL is fireproof, non-warping, cannot split, crack or rot, takes up little space, lasts a lifetime, keeps things tidy, is reasonable in cost, never needs repairs.

We make everything in modern shop equipment. including lockers, in all styles, standardized shelving, cabinets of every kind, tool stands, partitions, chairs and stools, draftsmen's desks, and a complete range of steel hospital equipment. Write for illustrated folders.

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON
CANADA

Halifax Montreal Ottawa Toronto
Winnipeg Calgary Vancouver


ILLINOIS
GAUGES
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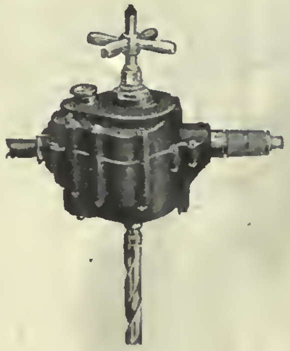
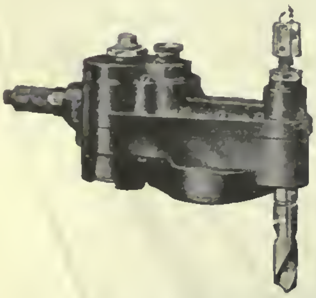
ILLINOIS TOOL WORKS
LIBERTY
ILLINOIS
The unvarying accuracy and dependability of
Illinois Tools make for better and more economical output,
thus they help in winning the world markets which American industry must reach and hold.
"NONE BETTER CAN BE MADE."
ILLINOIS TOOL WORKS
CHICAGO

The "JOHN BULL" PNEUMATIC TOOLS



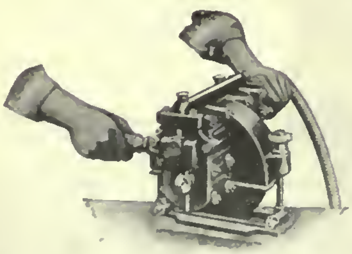


Pneumatic Riveters,
Drills, Chipping
and
Caulking Hammers,
Grinders,
Deck Planers,
Etc., Etc.

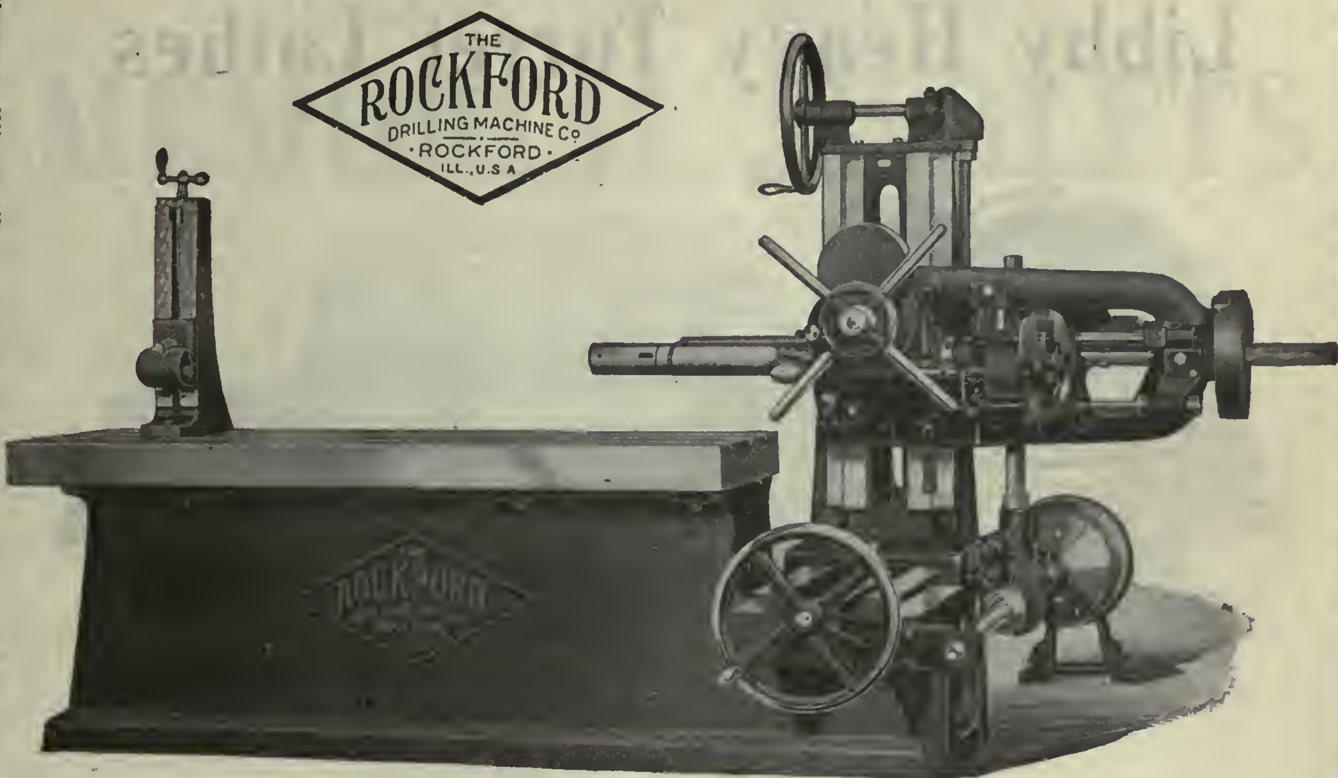
Sole Agents for Canada:

THE DOMINION MACHINERY CO.
110 Church St., Toronto

Machines and Spare Parts in Stock.



THE HOWARD PNEUMATIC ENGINEERING CO. LTD.
EASTBOURNE, *ENGLAND.*
ESTABLISHED 1904



A Horizontal Boring Machine

For Heavy Duty or Fine Jig Work

This wide range machine has the strength and rigidity to drive 2-inch high-speed drills to capacity and boring tools up to 8 inches and over, but is so carefully balanced and nicely adjusted as to adapt it equally well to the finest jig work.

Lateral and vertical adjustment of the head to permit the spindle to operate anywhere over a surface 18 by 36 inches; spindle of special forged steel, ground to size, has long nose with 5/8 x 5/8 slot in the end and is provided with ball thrust bearings. Steel gears provide nine different speeds without stopping the machine and the automatic trip guards against the spindle being advanced beyond its intended range of movement.

Six styles of drive: 2, 3 and 4-step cone with back gears, and 5, 4 and 3-inch belt respectively; gear box with tight and loose pulley; variable speed motor, directly connected, and constant speed motor with gear box (as illustrated). Complete description in Circular R-1.

Say you want all particulars.

Foreign Representatives:

R. S. Stokvis & Zonen, Ltd., Rotterdam, Holland; R. S. Stokvis & Fils, 103 Rue Lafayette, Paris, France; McPherson's Pty., Ltd., 554 Collins Street, Melbourne, Australia; Buck & Hickman, 2-4 Whitechapel Road, London, E., England; Burton Griffiths & Co., Ludgate Square, Ludgate Hill, London, E.C., England; Selson Engineering Co., Ltd., 24-26 Stone Street, New York City, N.Y.; Casamitjana Hermanos, Cortes 660, Barcelona, Spain.

BRASS AND BRONZE
MEMORIAL TABLETS

Engraved in High Relief or Sunk Letters, Filled with Red and Black Enamel.

REDUCED FROM LARGE TABLET.

Designs made on approval. Call and see sketches of plates made if convenient.

Every Industrial Plant Will Have its Memorial Tablet

Every industrial plant in Canada has sent its quota of men to the battlefields of Europe. Many of these men have made the supreme sacrifice. Among the fallen heroes are men from your plant. You will want a tablet erected to their memory.

Memorial Tablets are our specialty, and we can fill your requirements efficiently. Our prices are moderate.

STEEL STAMPS

For marking machinery and metal parts of all kinds. Our facilities place us in a position to give you the best of service.

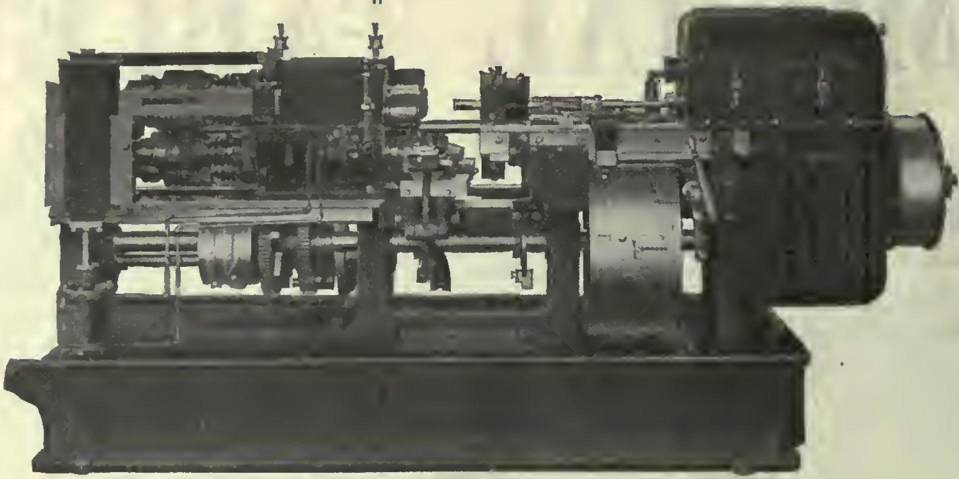
Get in touch with us. Enquiries of all kinds gladly and promptly answered.

PRITCHARD-ANDREWS COMPANY

ENGRAVERS AND BRASS WORKERS

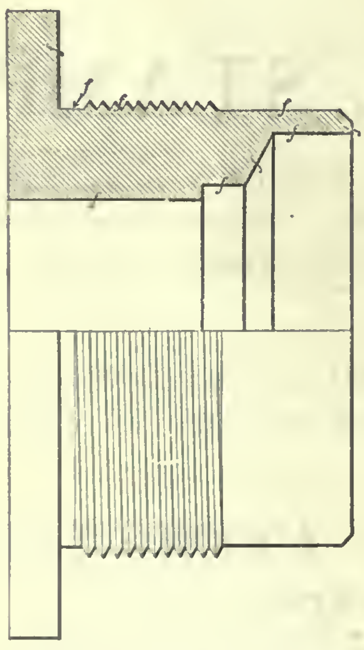
Established 38 Years

264 SPARKS STREET OTTAWA, ONT.



The New Britain Machine Company

New Britain, Conn. U.S.A.



Automobile Steering Case Adjusting Cap

Seven Operations at One Setting
—110 Times Per Hour

THIS is a **typical,** rather than unusual, example of the sort of work on which "New Britain" automatics are rendering yeoman service in the defense against the forces of advancing costs.

Seven distinct operations—turning, boring, counterboring, reaming, facing, necking and threading—are involved in machining this automobile part. **The series is completed and a finished piece delivered every thirty-three seconds!**

The expression **"All Operations Simultaneous and Automatic"** is indicative of the extent to which idle time and needless manual attention have been eliminated in the design of the "New Britain." Operator's **sole duty** is the insertion and removal of work.

A further advantage of these machines—**especially important at this time of labor scarcity**—is their capacity for successful operation by unskilled workers.

To those accustomed to handling such work in a turret lathe or hand screw machine, the radical saving to be effected by the adoption of "New Britain-Automatic" methods will be evident.

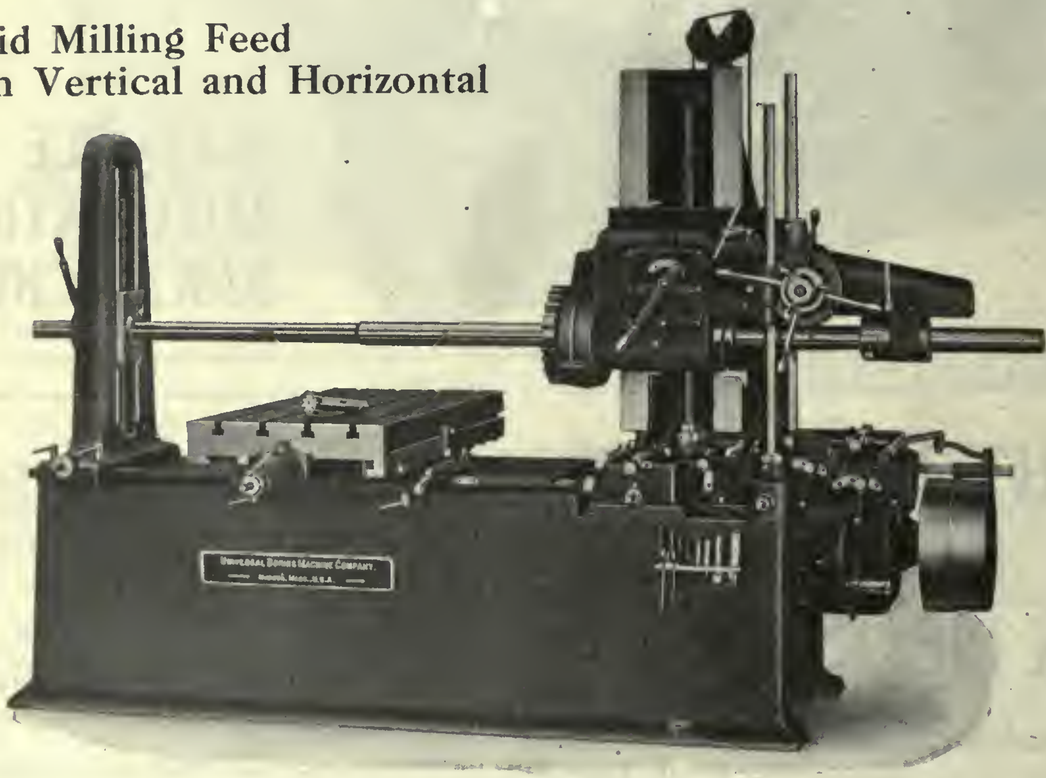
We stand ready to investigate the possibilities in your case.

Obligation? None whatever.

A Universal (Horizontal) Boring Machine

"Where Accuracy Counts We Win"

Rapid Milling Feed
Both Vertical and Horizontal



STANDARD SPECIFICATIONS

Size of Machines—	No. 3½	No. 3A
Diameter of Main Boring Bar	3½"	3"
Taper hole in Main Boring Bar, Morse	No. 6	No. 5
Travel of Main Boring Bar, Automatic	30"	28"
Travel of Main Boring Bar, by resetting	54"	56"
Size of Table	30" x 48"	24" x 48"
Power Cross Feed to Table	36"	35"
Power Longitudinal Feed to Carriage	56"	38"
Power Vertical Feed to Head	30"	26"

SPECIAL EQUIPMENT

Special Tables, Rotary Tables, Star Feed Facing Head, Face Milling Cutters, 2½", 3", 8", 10" and 12"

Send for our New Catalog.

Universal Boring Machine Company

Hudson, Massachusetts, U.S.A.

CUT GEARS

HAMILTON
MACHINE CUT GEARS

CUT GEARS

IF you would survive, meet after-the-war competition with quality products.

Hamilton Cut Gears have always been quality gears, and incorporated with your product will meet your highest standard.

We are ready to figure on your requirements.

HAMILTON GEAR & MACHINE CO.

VAN HORNE STREET TORONTO

Prepare *for* Permanent Peace

DIE BENCH AND VERTICAL MILL

BORING MILL

MILLING MACHINES

The views on these two pages are views of the most up-to-date Jobbing Machine Shop in the Dominion of Canada, barring none. There must be an underlying cause.

WINDSOR MACHINE AND TOOL WORKS

WINDSOR - - ONTARIO

ESTABLISHED IN 1910

PEACE has its needs as well as WAR

Tool Up to Supply Them

Form your own conclusions from a practical standpoint as to whether or not we can successfully execute your orders for jigs, tools, dies, fixtures, gauges and special machinery.

Consult us about your production problems. High standards will be required of Canadian workmanship. We are confident that we can assist you.

Fine Gauge and Tool Work

(THREAD GAUGES A SPECIALTY)

CORNER OF GRINDING DEPARTMENT

BATTERY OF SHAPERS

BATTERY OF LATHES

Tools made as You Want Them

BATTERY OF LATHES

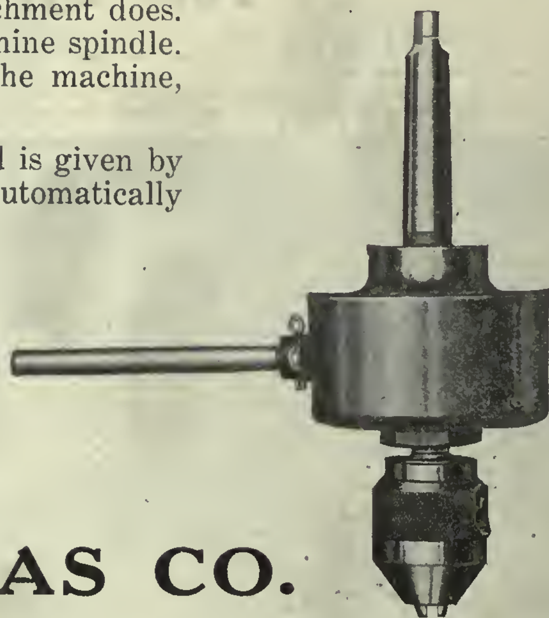
"B-T" Reverse Tapping Attachment

Saves Tap, Time and Trouble

That is what the "B-T" Reverse Tapping Attachment does. It eliminates the necessity of reversing the machine spindle. Simply raising the spindle reverses the tap—the machine, meanwhile, goes ahead at full forward speed.

A reverse speed twice that of the tapping speed is given by an internal gear drive. It is friction driven—automatically adjusted by the amount of pressure the operator puts on the drill spindle. It saves taps, trouble, time and money.

Can also be had with positive drive. Both plain and friction chucks are fitted with jaws to grip round and square end of tap.

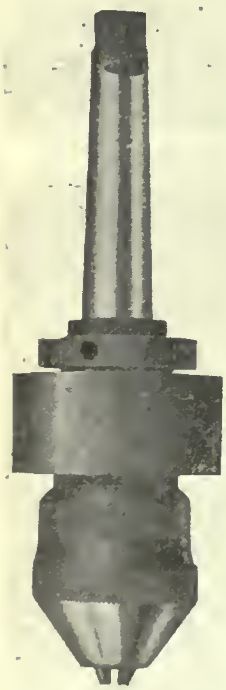


Get the details—In our Bulletin.
Write to-day.

BICKNELL THOMAS CO.

GREENFIELD, MASS., U.S.A.

Another Broken Tap!



Same old story: tap running at high speed—meets hard spot in metal—strain too much for tap—*snap*—get a new tap. Happens every day unless you use

Bicknell-Thomas Friction Chucks

The instant the tap binds with a "B-T" the friction grip holding the tap slips, relieving overstrain, and prevents tap twist or breakage.
Compact; used on multiple-spindle drills and many other machines. Five sizes ⅛"—1"; either straight or Morse Taper Shanks.

How would you like to try one?

B-T THREAD LEAD INDICATOR

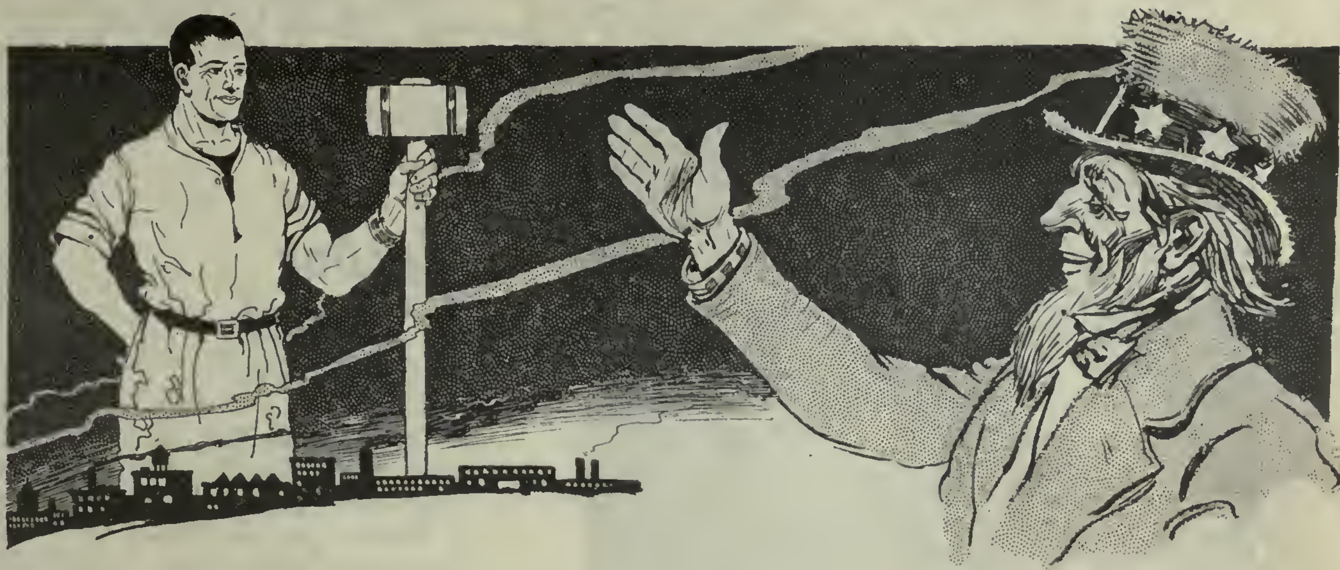
Exit—Spoiled Parts

Did you ever have to scrap a threaded part because of incorrect measurement in lead. Were you ever forced, during a rush job, to thread a part over again, because it didn't fit as it should?

B-T THREAD INDICATORS

enable you to get the right thread lead instantly and maintain a constant check upon it. They will detect errors of one thousandth of an inch—can be used for testing odd and even pitches, as well as internal and external threads.

SEND FOR OUR BOOKLET.

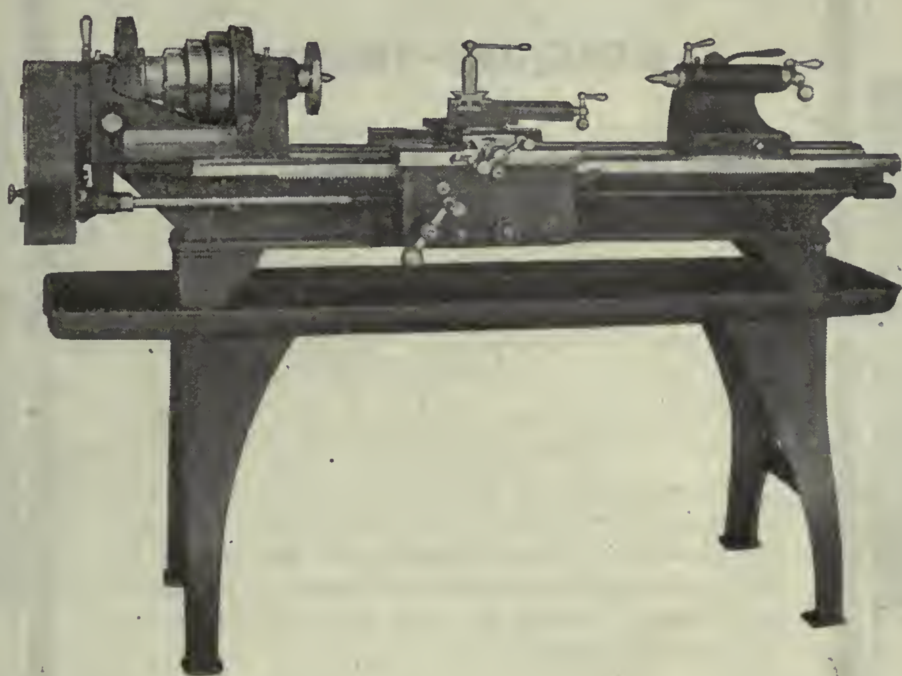


STAR TRADE MARK REGISTERED

STAR LATHES

STAR TRADE MARK REGISTERED

9"—11"—13" SWING



ACCURATE—RIGID—ECONOMICAL

BUILT WITH A FULL LINE OF

ATTACHMENTS

THE SENECA FALLS MFG. CO.

SENECA FALLS, N.Y., U.S.A.

BRIQUET INGOTS
for the Arts of Peace
With the war-demon chained, we hope **forever,** the arts of peace will clamor for brass and **more** brass; and every ounce that both Canada and the United States can produce will be required for railroad, marine and industrial work, at home and abroad.
BRIQUET-INGOTS
(Trade Mark)
will serve peace as they have been serving war by putting into meltable form thousands of tons of chips and finely-divided scrap—purified of iron and all other foreign substances.
COPPER, TOO
A later development is the purification and briquetting of copper shell-band turnings and similar copper waste. This is done, for the present, at our Chicago plant only.
Briquet-Ingots are made only by us. The name is our trade-mark and the processes and machinery patented. **Briquet-Ingots** are practically as uniformly pure and permanently solid as virgin cast ingots, though no heat and no binder are used in their manufacture.
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of NEW YORK
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MEET YOUR EVERY NEED
Copper and coppered belt rivets and burrs, tubular rivets, bifurcated or slotted rivets—rivets in every design and every size, from ⅝ inch to the smallest made.
You will find all P. & B. rivets of reliable quality and our service the kind you like. *Write.*
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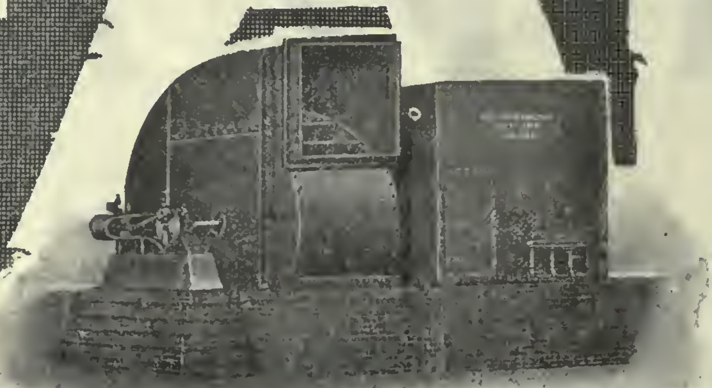
FAN



SYSTEMS

of Heating and Ventilation

Machine Shops, Foundries, Bridge Works, Woodworking Plants, Spinning Mills, Paper Mills, Auditoriums, etc., etc., are heated efficiently and economically with the Reith Fan System.

A FEW ADVANTAGES:

(1) Entire system under one man's control.

(2) Building may be heated up quickly in the morning.

(3) No leaky valves or frozen pipes around the building.

(4) Heater coils will stand pressure of 100 lbs. and over.

(5) System may be used for cooling in hot weather.

Take advantage of our experience and let our engineers solve your heating problem for you.

SHELDONS LIMITED

GALT, ONTARIO, CANADA

Sales Offices:

Sheldons Limited, 505 Kent Bldg., Toronto; Ross & Greig, 412 St. James St., Montreal; Walkers Limited, 259 Stanley St., Winnipeg; Robt. Hamilton & Co., Bank of Ottawa Bldg., Vancouver; Gorman, Clancey & Grindley, Ltd., Calgary and Edmonton.

Starrett

Test Indicators

Dependable Tools

Starrett Tools are known and recognized the world over as the most dependable tools for any accurate measuring operation.

Mechanics rely upon them for important, accurate test work.

Dealers carry them because they mean better satisfied customers.

Write for our Catalog No. 213. It shows our complete line of tools in the many styles and sizes as well as hack saws. Write for a copy to-day.

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Mfrs. of Hack Saws Unexcelled
ATHOL, MASS.

NEW YORK LONDON CHICAGO

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National—Cleveland
THE NATIONAL TOOL
Milling Cutters
For Every Requirement
SHELL FINISHING TOOLS
THREAD MILLING CUTTERS
BORING BLADES, BAND
GROOVING AND FINISHING
TOOLS
The National Tool Co.
Cleveland, Ohio
Chicago Office
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Philadelphia Office
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These Items Spell

QUALITY

FIRST COST + OPERATING COST + MAINTENANCE COST + ADAPTABILITY + EFFICIENCY + EFFECT ON PRODUCTION + SATISFACTION

in Lamps

FIRST COST alone is **never** the criterion by which to gauge QUALITY. There is **no** "Quality" that does not contain **most** of these elements---LACO LAMPS contain them **all.** You may hesitate at the larger investment, but don't let the bogey of "First Cost" run away with your better judgment. If you **want** QUALITY in your purchase, you **must** pay for it. Analyze the LACO standard:---

First Cost--slightly higher than the best "ordinary" lamp.

Operating Cost Lower—30 to 50% less current consumption per 1,000 hours for same quantity of light. One official test, for instance, showed 4 Laco Lamps burning 936 watts, gave the same light as 4 competitive lamps burning 1443 watts.

Maintenance Cost Lower—25 to 40% longer life. (Replacement cost of 4 brands in same 1000-hour test averaged $12.68—LACO none.) Guaranteed life of ordinary 1000 watt lamp is 1000 hours, but actually averages much less. LACO Lamps are *guaranteed* for 1500 hours' life, and users frequently get two to three times this service; we can quote LACO Lamps that lived over 10,000 hours.

Adaptability—LACO Tungsten Lamps are made in sizes up to 60 watt; LACO Nitro are made in sizes 60, 100, 200, 250, 300, 350, 400, 500, 750 and 1000 watt—a LACO size for every need.

Efficiency—LACO Lamps are guaranteed to give the candle-power U.S. standard specifications provide. They furnish a clear, brilliant, colour-true, daylight ray.

LACO LAMPS

Effect on Production—
Government statistics have proved that the LACO quality of lighting will increase workers' earnings; one example alone showed 11.4%.

Satisfaction--Is found in hundreds of letters from big operators in every line of business all over the country, telling their experience with LACO LAMPS. Read examples quoted.

Without cost to you—our nearest office will have official laboratory tests made of your lamps to prove our claims. Our lighting engineers will plan and submit an installation to meet your exact requirements in the best and most economical way.

Write us to-day for descriptive literature

RECEIVED MAR 11 1918

BRITISH COLUMBIA ELECTRIC RAILWAY CO., LTD.
HASTINGS AND CARRALL STREETS
VANCOUVER, B.C.

LIGHT & POWER SALES DEPARTMENT Mar. 8th, 1918.

Canadian Laco-Philips Company,
Standard Bank Building,
Cor. Richards & Hastings Sts.,
VANCOUVER, B.C.

Dear Sir:-

Attention of Mr. Willard.

We take pleasure in writing you of the excellent service given by Laco-Philips lamps and we are particularly impressed with the satisfaction our customers obtain, the percentage of defective lamps being extremely low.

We are also using your series lamp for street lighting and find that they give excellent satisfaction.

Yours truly,

SALES ENGINEER.

JP/AR.

THE ROBERT SIMPSON COMPANY LIMITED

Laco-Phillips Co.,
C.P.R. Bldg.,
Toronto.

Toronto, Nov. 10th, 1917.

Gentlemen:

Our store has been equipped throughout with your Laco Nitrogen filled Lamps since September, 1914 with very satisfactory results. During that time we have kept a very close record of the life of the various sizes in use and the following is a list of the average hours burning, taken from records kept since 1914.

500 Watt average 2766 hours. 400 Watt average 2632
350 " " 1600 " 250 " " 2306
100 " " 1200 "

We have also installed several of your Nitro Lamps in our Toronto and Regina Mail Order Buildings along with your 40 and 60 Watt Tungsten Lamps with equally good results.

Trusting this information will be of service to you, we are

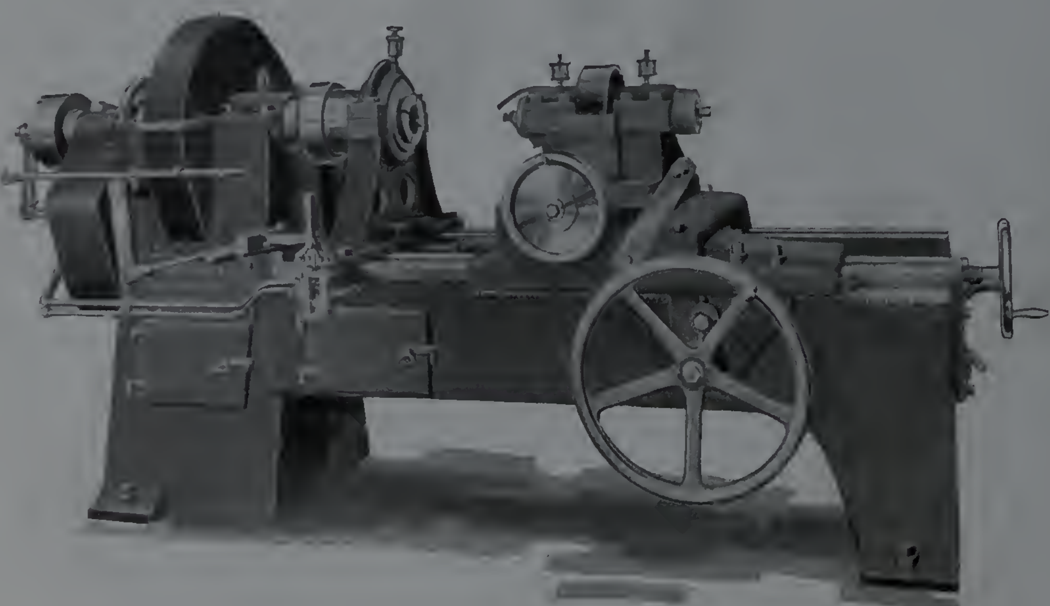
Yours very truly,
The Robert Simpson Co.
per W. Dutton
Chief Engineer.

WD/WA

Canadian Laco-Philips Company, Limited:

Montreal Toronto Winnipeg Vancouver

Smalley General Thread Milling Machine



The machine that gives production and satisfaction, built in five sizes and for all classes of threading work. Equally well adapted for munition or general manufacturing purposes.

Write for catalogue or information on thread millers, air cylinders, or chucks.

SMALLEY GENERAL CO., INC.

BAY CITY, MICH., U.S.A.

RUDEL-BELNAP MACHINERY CO. LIMITED

TORONTO MONTREAL

STRENGTH

to match the producing power of your Heavy Duty Drill Presses

CELFOR

HIGH SPEED TWIST DRILLS

No longer is it necessary to "go easy" with your High Speed, Heavy Duty Drill Presses for fear of burning up your drills.

No pace is too great for Celfor Drills. The chief reason is in the forging process by which the "Celfor" is made. The original grain or fibre is kept intact; there is no deep milling. Instead, the grain runs with the twist. So strong is the flute and so great the cutting powers that an over-size shank is required to utilize them.

There are other reasons why the call for the "Celfor" is growing constantly louder as the need for production increases. Let us show you.

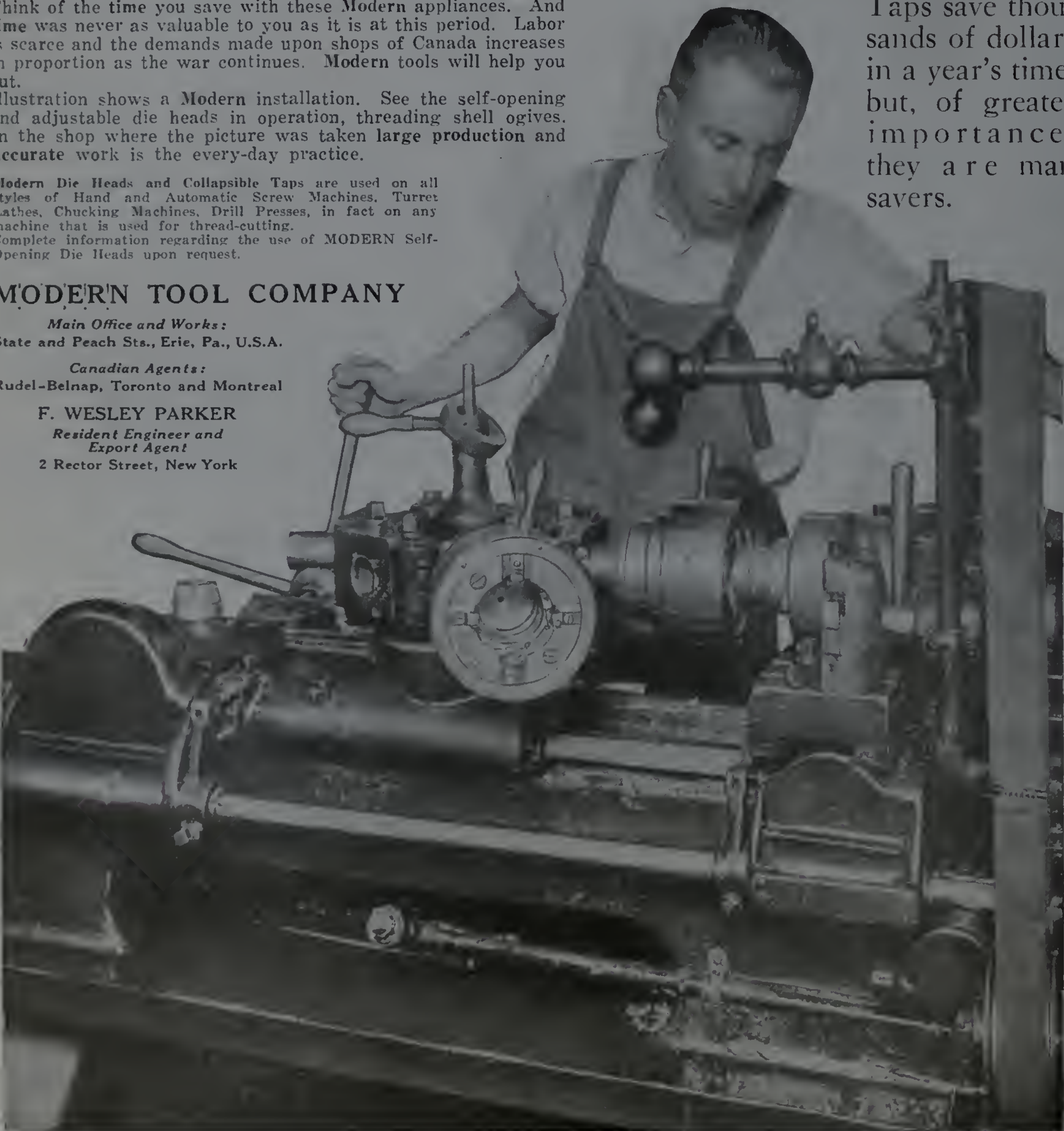
Clark Equipment Co.

Main Office and Works

BUCHANAN, MICH.

AGENTS — Canada — Rudel-Belnap Machinery Co., Montreal and Toronto. Great Britain—The Coats Machine Tool Co., Thanet House, London. Japan—Andrews & George, Tokyo.

CELFOR

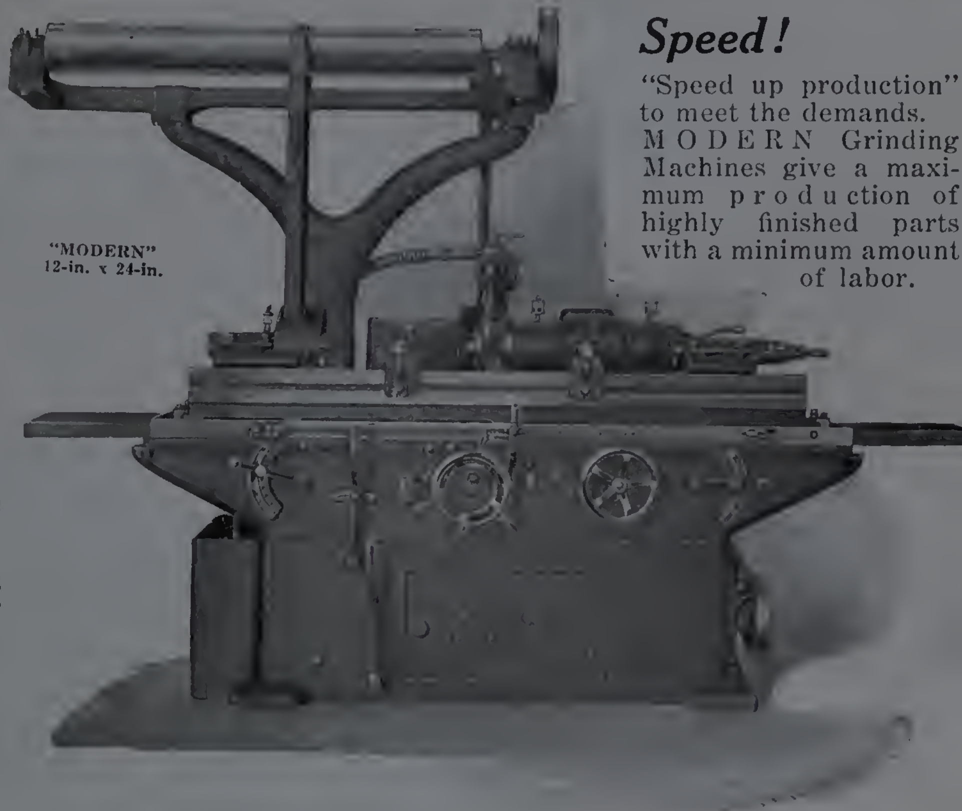


RUDEL-BELNAP MACHINERY Co. LIMITED
TORONTO MONTREAL

Modern Self-Contained Plain Grinding Machine

Every means for convenient, rapid and positive operation is employed with a view to minimizing the labor.

MODERN Grinding Machines are made in a wide range of sizes and include Plain, Universal and Internal Types.



"MODERN" 12-in. x 24-in.

Speed!

"Speed up production" to meet the demands. MODERN Grinding Machines give a maximum production of highly finished parts with a minimum amount of labor.

Modern Die Chaser

MAKE YOUR DIE TROUBLES A THING OF THE PAST

Nine-tenths of all die troubles is due to imperfect grinding, and a sure, efficient and quick way to eliminate this trouble is to install a MODERN Chaser Grinder. Made for belt drive or a complete motor driven unit.

Special attachments for grinding Spring Dies, Pipe Dies, Reamers, Taps, Hobs, Spiral and End Mills, Milling Cutters, etc., can be furnished with the regular equipment.

Bulletin CG will tell you all about it.

Progressive manufacturers everywhere have realized the advantage of equipping with MODERN Machines and Tools.

SERVICE IS OUR WATCHWORD

MODERN TOOL COMPANY

Main Office and Works:

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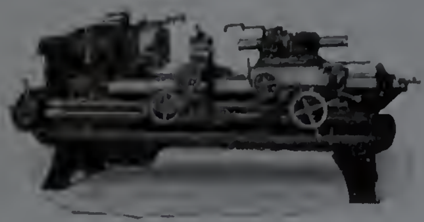
Canadian Agents: Rudel-Belnap Machinery Co., Toronto and Montreal

New York Office: 50 Church Street Chicago Office: 32 N. Clinton Street

F. WESLEY PARKER
Resident Engineer and Export Agent
2 Rector Street, New York

RUDEL-BELNAP MACHINERY Co LIMITED
TORONTO MONTREAL



No. 3 Universal Flat Turret Lathe with Chucking Equipment.

Flat Turret Lathes
Screw Machines
Turret Lathes

CINCINNATI ACME

$2\frac{1}{4}$" x 11" Screw Machine.

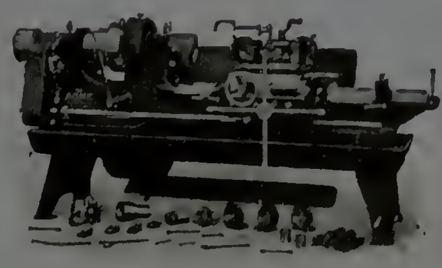
IN adopting Cincinnati Acme equipment you have the assurance of a complete line of the highest quality machinery backed by the responsibility of one maker.

Boosts Production Lowers the Cost

Cincinnati Acme machines are doing it for some of the largest manufacturing concerns of the country. Besides boosting production you'll find they sustain their accuracy at all times, and will handle a great variety of work. They are built for years of rough usage, and save a great deal of the operator's time by their many features which cannot be found on similar types.

18" Turret Lathe.

Our engineering department will gladly facilitate the solving of your problem and make no charge for the service.



$2\frac{1}{4}$" x 26" Flat Turret Lathe with Bar Equipment.

The Acme Machine Tool Company
CINCINNATI, OHIO, U.S.A.

Canadian Agents:
Rudel-Belnap Machinery Co., Montreal, Toronto

More Necessary Now Than Ever—

The war taught us all many things about gages and gaging systems. Gaging made possible the greatest production of machine shop products ever attained in the Dominion.

And now that peace is here the advantages of gaging will be more necessary than ever.

Johansson Combination Gage Blocks give you a standard that permits you to maintain your gages in the face of inevitable wear. They are in use by practically all big toolrooms.

Johansson Adjustable Limit Snap Gages are put into the hands of operators and inspectors after being carefully set and sealed to the "go" and "not go" sizes of the work to be gaged. They prevent the attempt to work to "absolute dimension," and can be reset as often as is necessary to keep them to size—when sizes change, when limits change or when wear takes place.

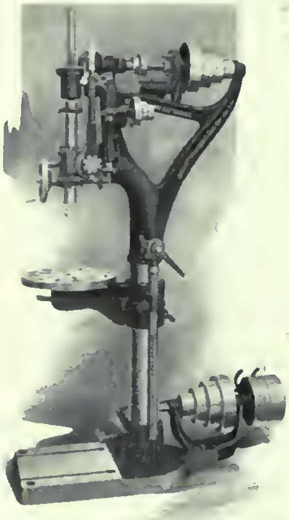
Twenty-one sizes give all dimensions up to 12 inches.

Be sure to get our new catalog and discounts.

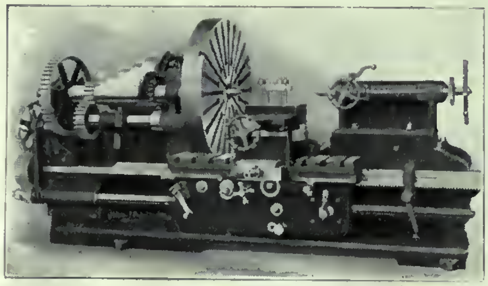
Johansson Gaging System

The Swedish Gage Company
10 Cathcart Street, Montreal

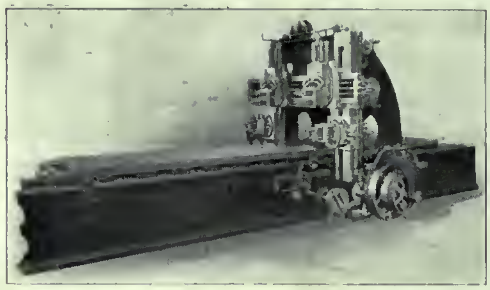
Ryerson Light and Heavy Duty Machine Tools



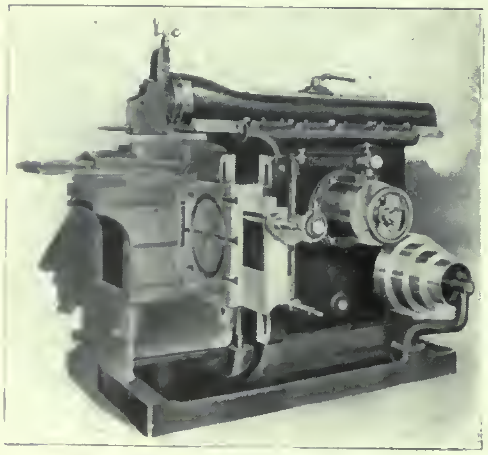
A light type drill, having hand wheel, hand lever and automatic feed.



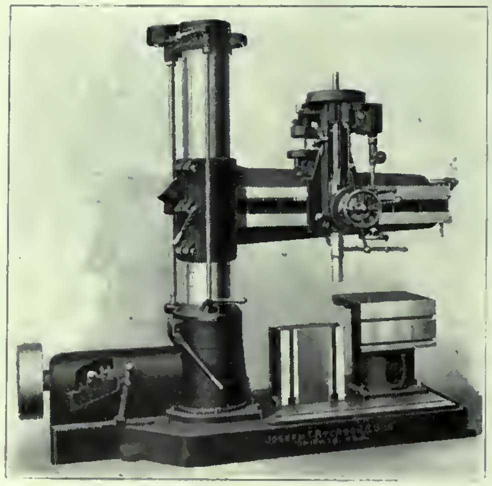
This type of Lathe furnished in various sizes from 34" to 96" swing.



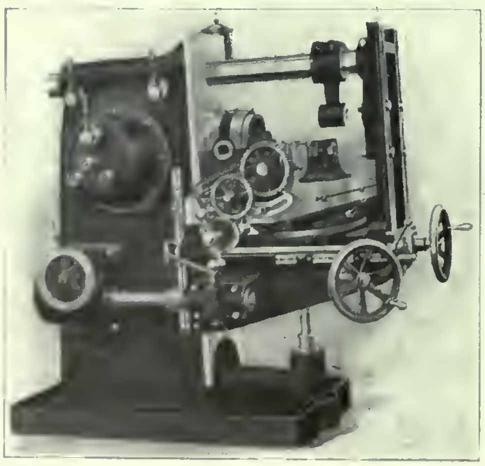
Ryerson Planers are designed to meet all conditions influencing modern shop work and have every facility for high speed production and accuracy of alignment.



Shapers of any standard size can be promptly shipped from stock.



Ryerson 4' Plain Radial Drilling Machine with gear box drive.



No. 3 Ryerson-Conradson High Power Single Pulley Drive Universal Milling Machine.

GARLOCK-WALKER MACHINERY CO. LIMITED

G&W MACHINERY

TORONTO MONTREAL WINNIPEG

REPRESENTATIVES OF

JOSEPH T. RYERSON & SON

CHICAGO, ILLINOIS, U. S. A.

RYERSON SPECIAL MACHINERY AND MACHINE TOOLS

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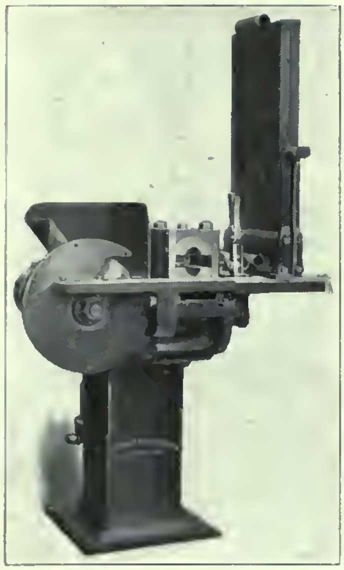
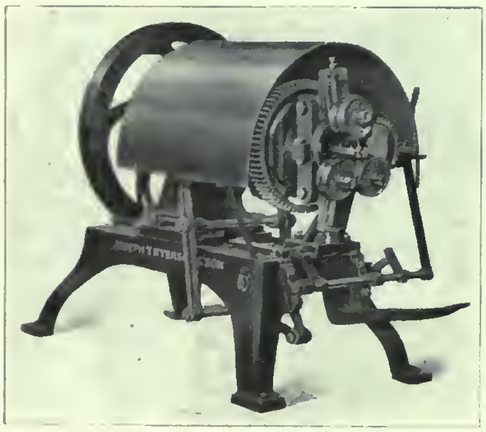
Flue Shop Equipment

Full Range of Flue Shop Equipment and Reclaiming Machines

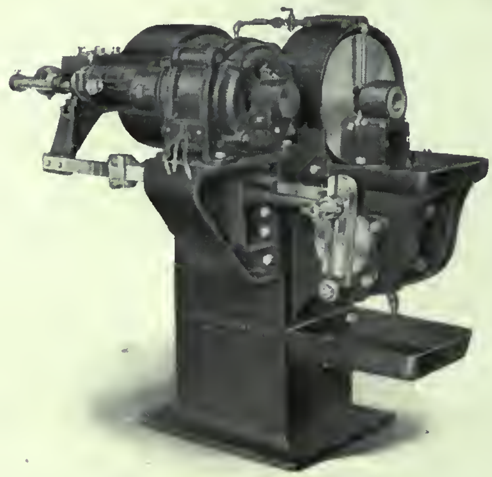


Ryerson Hot Saw and Tube Expander.

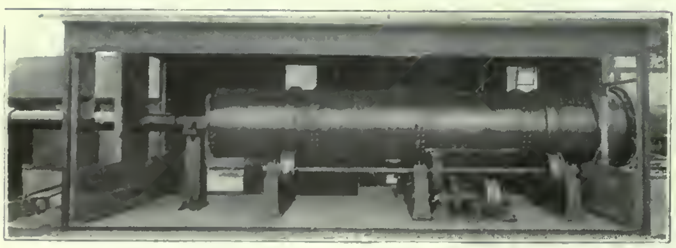
A Universal Machine for cutting and cleaning from 1½" to 6½" flues.



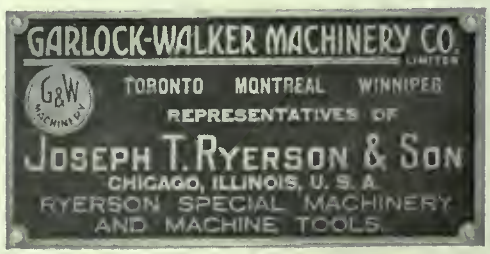
The Hartz Flue Welder. A machine particularly adapted for railroad shops.



With this machine safe ends are accurately cut to length, scarfed and finished complete in any length from 2¼" to 12".



The Ryerson-Baird Flue Rattler will clean 300 2¼" tubes at one time.



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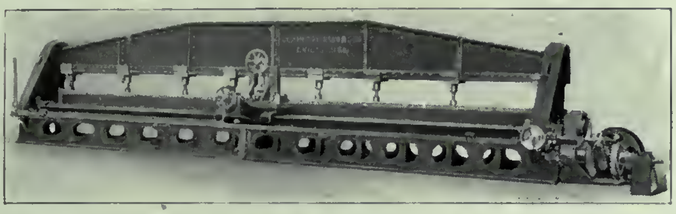
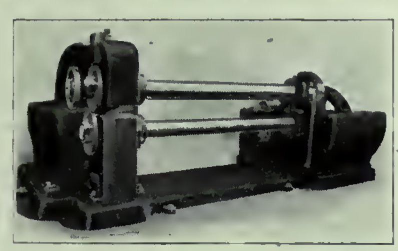
Metal Working Machinery

For Structural and Bridge Works, Tank and Boiler Works, Shipyards, Car and Locomotive Works and Railway Repair Shops

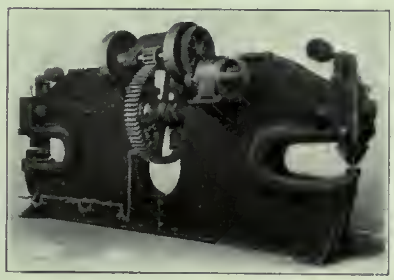


We build Plate Planers of any required size, arranged for belt or motor drive and equipped with pneumatic, hydraulic or screw jacks.



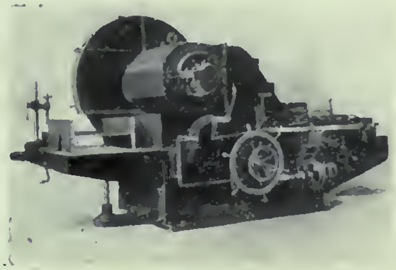
This machine is designed for straight shearing of sheets and plates and can be efficiently used for cutting round and square or flat bars.

The most efficient machine now on the market for beveling irregular and curved sheets, boiler heads, flanges, dome sheets, plates, angles, etc.

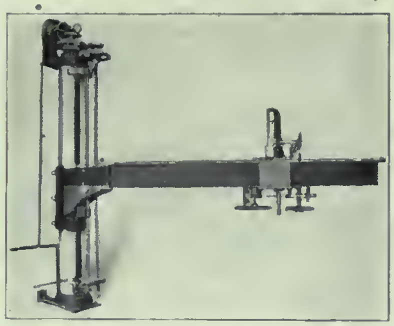


We can furnish Cored Frame or Solid Frame, Single or Double End Punches and Shears of various capacities and depths of throats.

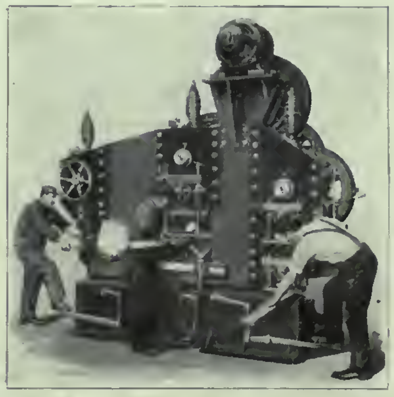
Plate Bending Rolls of any capacity and distance between housings and arranged for belt or motor drive can be furnished upon request.



No. 4 Ryerson High Speed Friction Saw for cutting Structurals, round and square bars.



Ryerson Boiler Shop Radial Drill is designed principally for the use of boiler makers, bridge and shipbuilders.



Ryerson Steel Frame High Power Quintuple Punching and Shearing Machine, built in different sizes and with various combinations.

The Sign of Service

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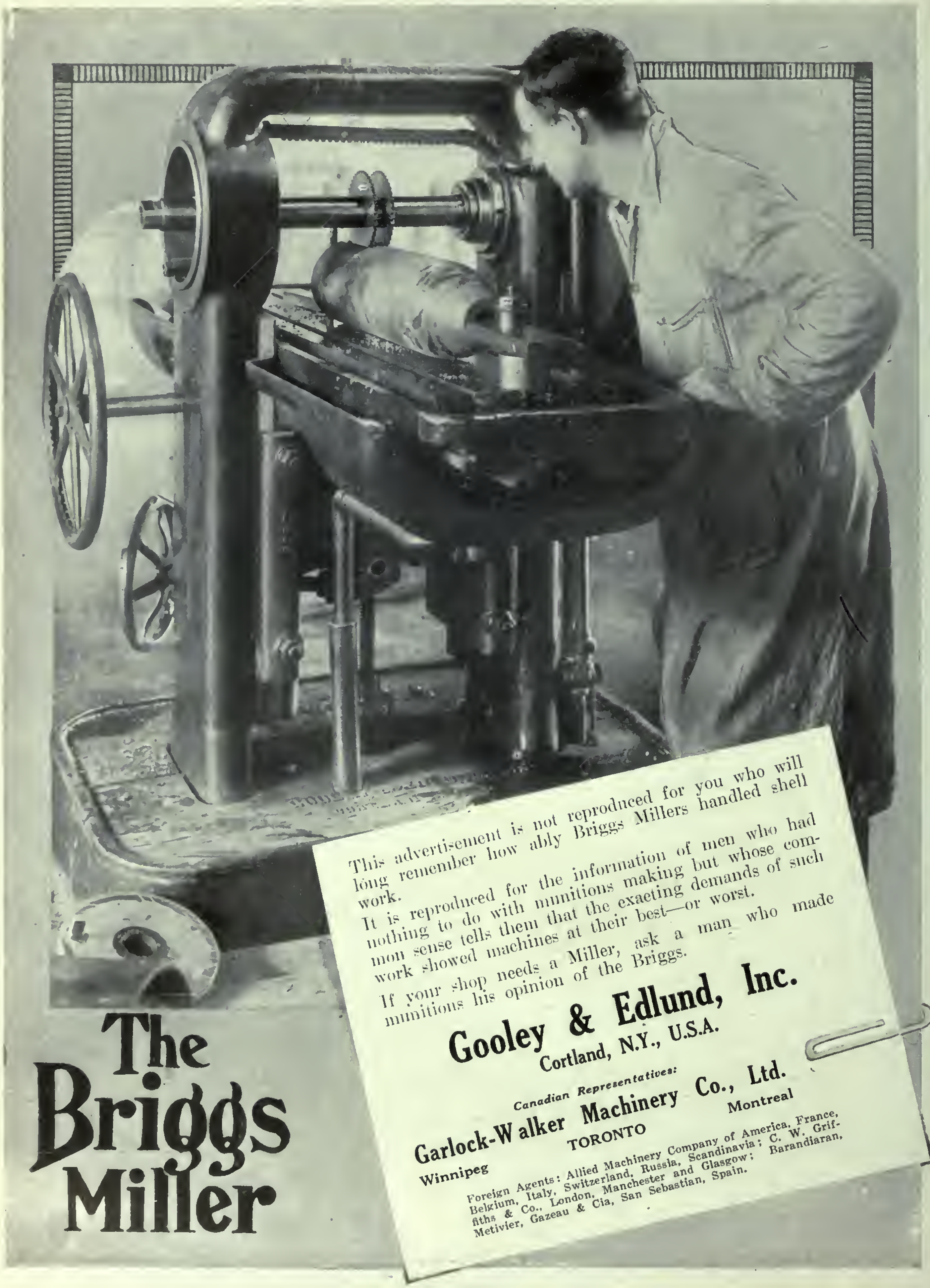
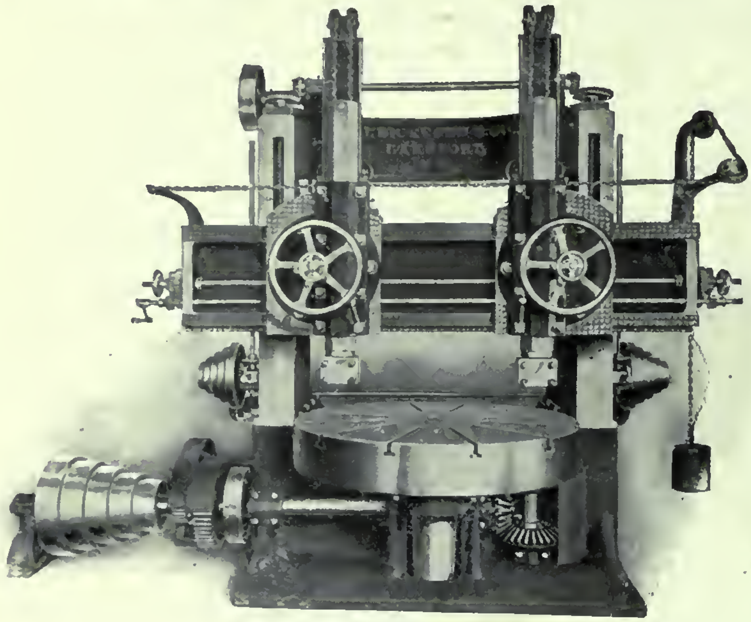

This advertisement is not reproduced for you who will long remember how ably Briggs Millers handled shell work.
It is reproduced for the information of men who had nothing to do with munitions making but whose common sense tells them that the exacting demands of such work showed machines at their best—or worst.
If your shop needs a Miller, ask a man who made munitions his opinion of the Briggs.
Gooley & Edlund, Inc.
Cortland, N.Y., U.S.A.
Canadian Representatives:
Garlock-Walker Machinery Co., Ltd.
Winnipeg
TORONTO
Montreal
Foreign Agents: Allied Machinery Company of America, France, Belgium, Italy, Switzerland, Russia, Scandinavia; C. W. Griffiths & Co., London, Manchester and Glasgow; Barandiaran, Metivier, Gazeau & Cia, San Sebastian, Spain.
The Briggs Miller

Vertical Boring and Turning Mills

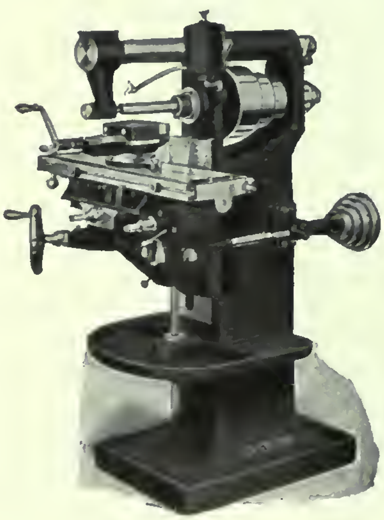


Handle a wide variety of work, not expedient on other machines, particularly the unusual—the irregular.

Ask us for particulars on any size; single or double heads, motor or belt drive.

Save on Your Small Work

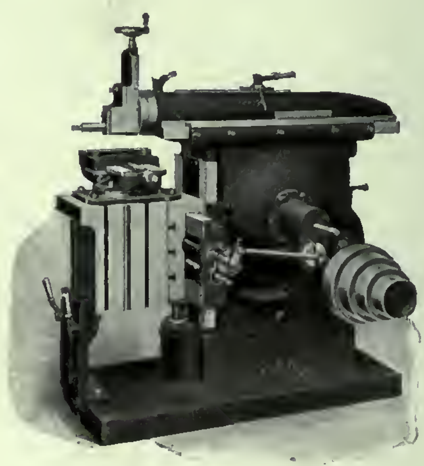
It certainly is false economy to use your large Planers and Millers for small work. A small machine can be handled so much more quickly than the larger that the saving in time and labour is obvious.



The John Steptoe Co., Cincinnati, specialize in building Shapers and Millers.

Get our bulletins describing **Shapers,** 16-in., 20-in., 24-in. single or back geared.

Millers, hand or power feed, lever or screw elevation, plain or back geared.



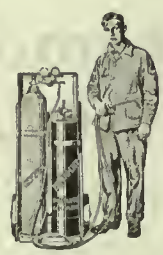
Garlock-Walker Machinery Company

Limited

32 Front St. West, TORONTO, Canada

TORONTO MONTREAL WINNIPEG

"Everything in Woodworking and Metalworking Machinery"



A Little Talk on Compressed Air

USE compressed air in the machine shop for direct lift hoists and air chucks, in the assembly shop for pneumatic chipper and drill, in the foundry for sand-rammer and "Imperial" motor-type hoist. Think of the future trade ahead of Canada and prepare.

Be Prepared for the Big Trade to Come

We stand ready to help you in your after-the-war problems. C-I-R-Co Air Compressors, Pneumatic Tools of all kinds, air hoists, direct and motor types, are all backed by our twenty-five years' experience in the Canadian trade.

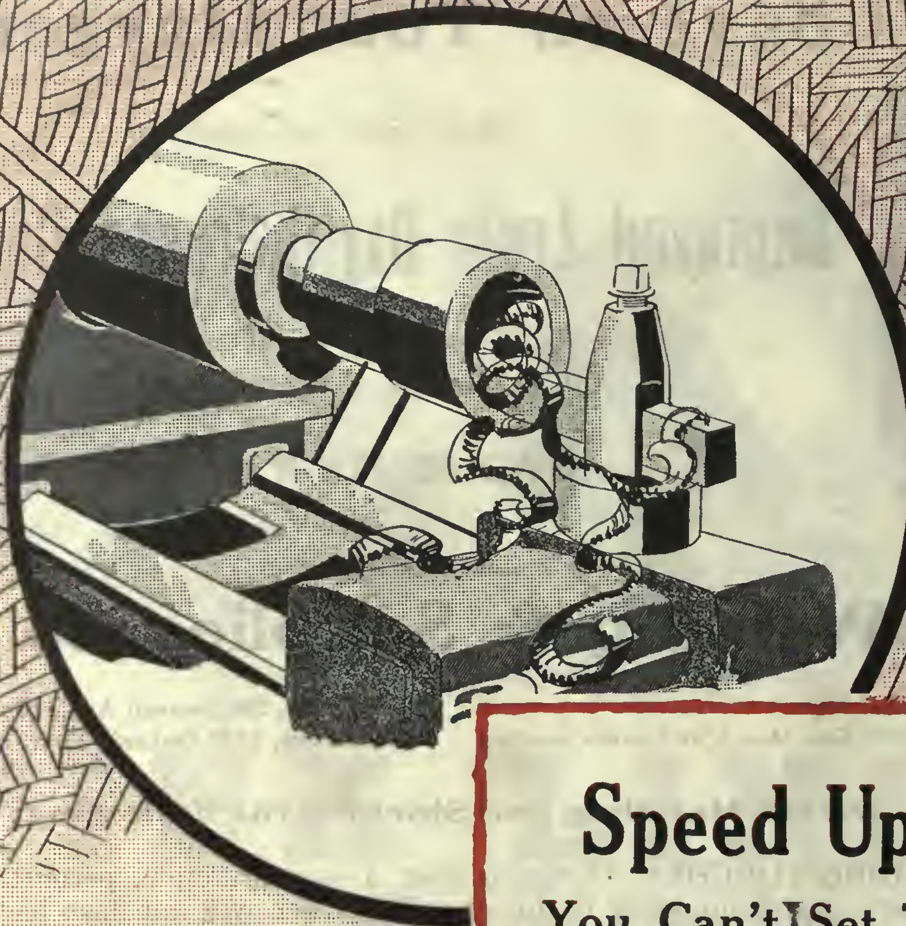
C-I-R-CO stands for service

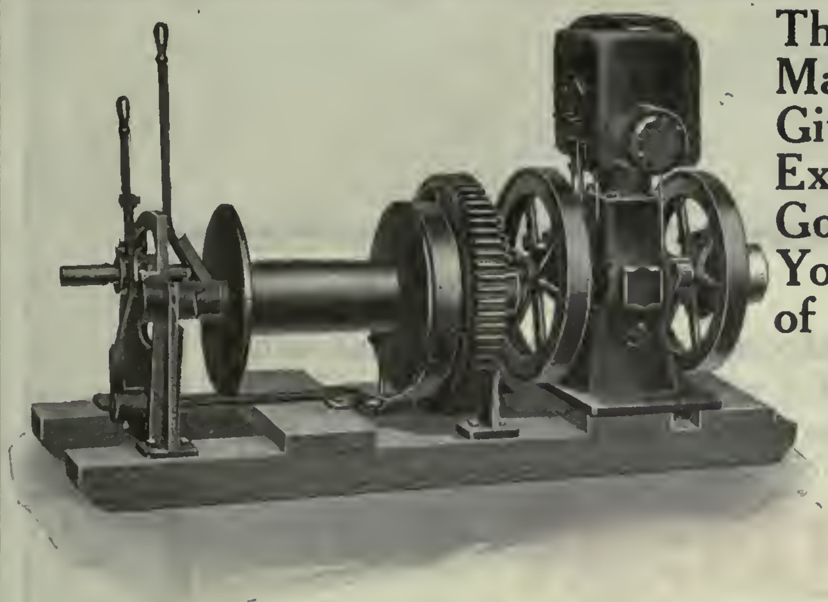
Canadian Ingersoll-Rand Company

CANADIAN INGERSOLL-RAND CO., LTD.

With Offices at

SYDNEY, SHERBROOKE, MONTREAL, TORONTO, COBALT, TIMMINS, WINNIPEG, NELSON, VANCOUVER





These Machines Give the Exceptionally Good Service You Expect of Them

Showing our No. 1 Hoist with gasoline engine.

Our Steam Engines built to stand up. Do not fall down on the job.

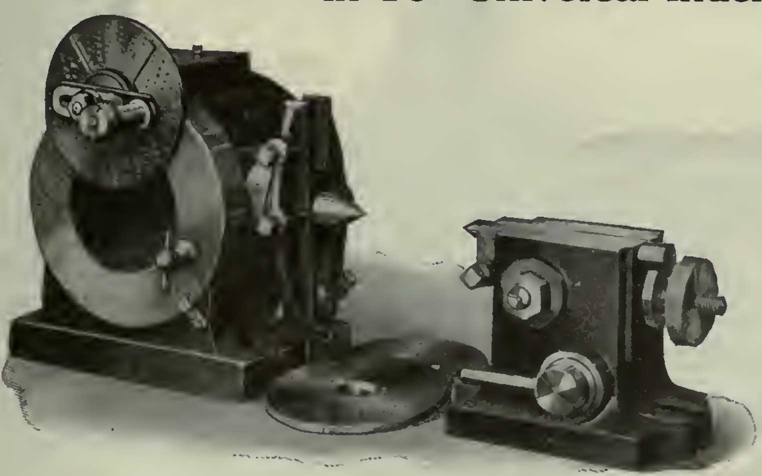
Write for circular of other sizes, styles, prices, etc. WE ALSO MANUFACTURE Concrete Mixers, Pumps, Wheelbarrows, Contractors' Machinery, Special Forgings, Drop Forgings, etc., etc.

WRITE FOR PRICES AND DELIVERIES

ST. CLAIR BROTHERS, GALT, ONTARIO, CANADA

Can Absolutely Guarantee

The highest degree of Accuracy obtainable in 10" Universal Index Centers



In our many years of experience and specializing on Index Centers. We have developed many special machines, fixtures, testing tools, for making Index Centers accurate.

PROMPT DELIVERY

DICKOW

ACCURACY DICKOW QUALITY

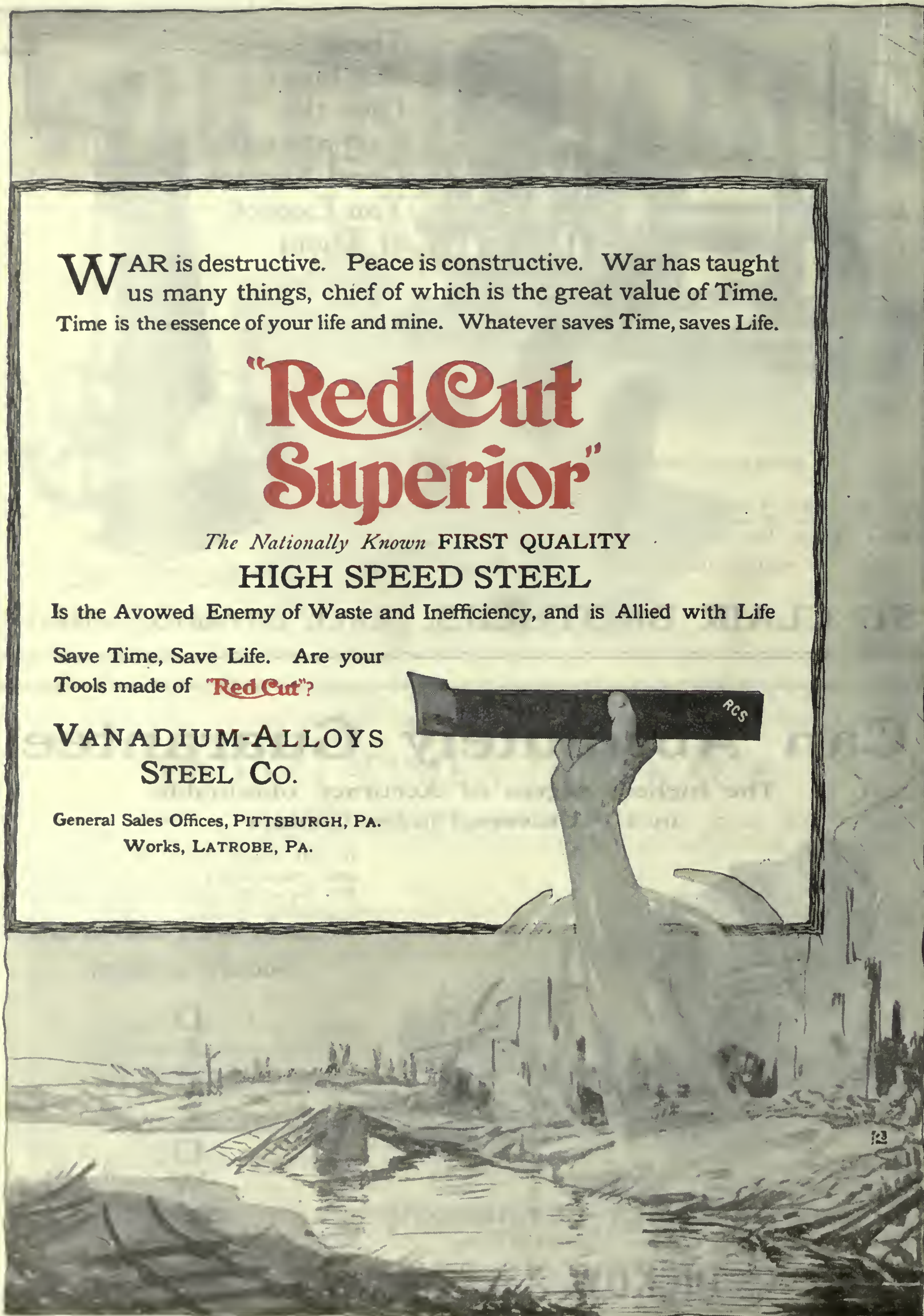
Patents Pending.

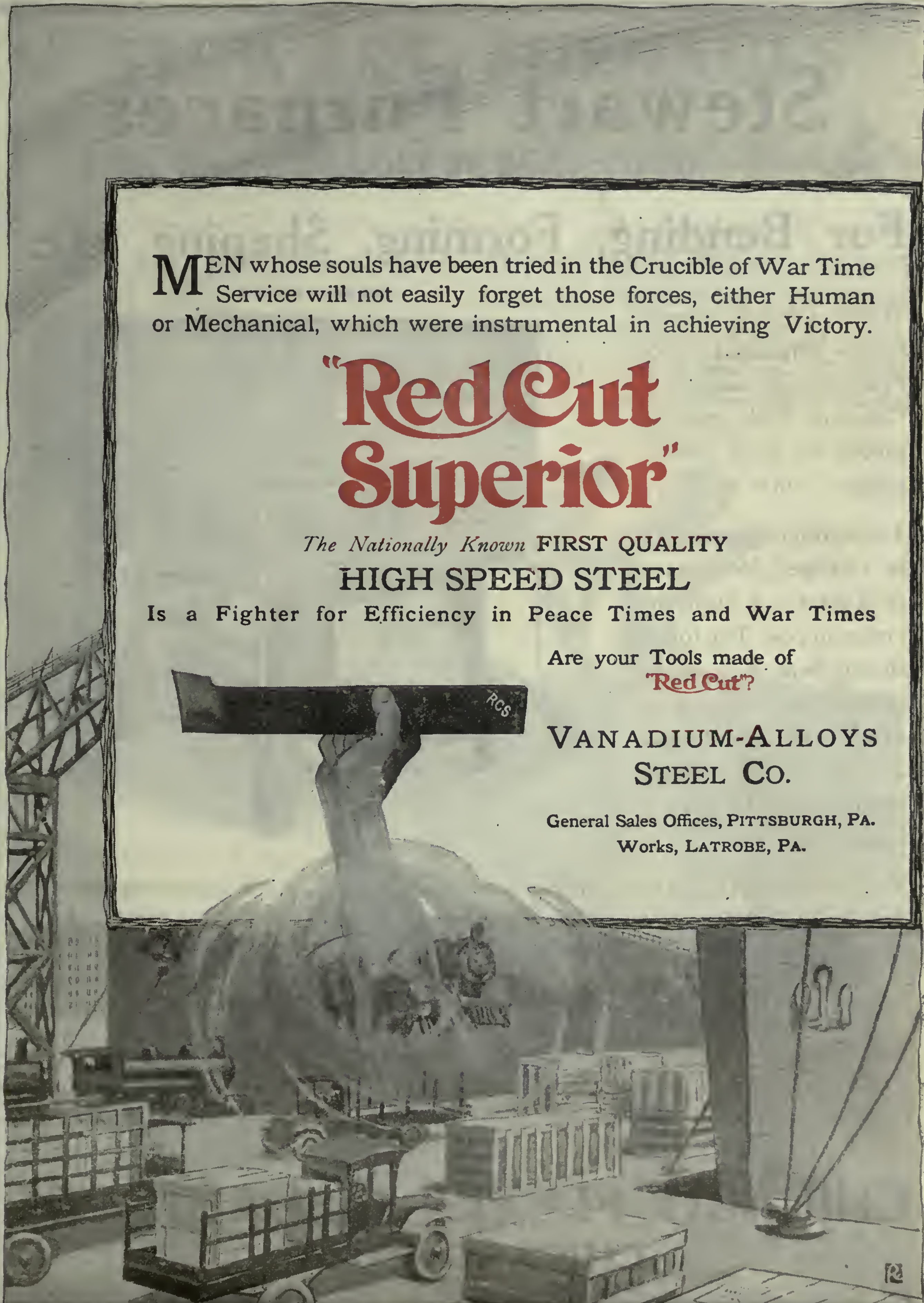
FOR ACCURACY GET DICKOW'S

Sold by dealers. Write us to-day.

FRED. C. DICKOW 37 So. Desplaines Street CHICAGO, ILL.

If any advertisement interests you, tear it out now and place with letters to be answered.


WAR is destructive. Peace is constructive. War has taught us many things, chief of which is the great value of Time. Time is the essence of your life and mine. Whatever saves Time, saves Life.
"Red Cut Superior"
The Nationally Known FIRST QUALITY
HIGH SPEED STEEL
Is the Avowed Enemy of Waste and Inefficiency, and is Allied with Life
Save Time, Save Life. Are your Tools made of "Red Cut"?
VANADIUM-ALLOYS STEEL CO.
General Sales Offices, PITTSBURGH, PA.
Works, LATROBE, PA.
RCS


MEN whose souls have been tried in the Crucible of War Time Service will not easily forget those forces, either Human or Mechanical, which were instrumental in achieving Victory.
"Red Cut Superior"
The Nationally Known FIRST QUALITY
HIGH SPEED STEEL
Is a Fighter for Efficiency in Peace Times and War Times
Are your Tools made of "Red Cut"?
RCS
VANADIUM-ALLOYS STEEL CO.
General Sales Offices, PITTSBURGH, PA.
Works, LATROBE, PA.

STEWART FURNACES

(GAS OR OIL)

For the Heat Treatment of Metal

No. 28 Oven

Ovens (indirect heat) in all sizes from the small one to the left with heating space 8 in. x 12 in. x 4 in. high for carbon or high-speed steel, to the one shown below with an opening 20 in. high, 36 in. wide and 72 in. deep. For treating motor cylinders, shell cases, case hardening, annealing, etc.

No. 36 Oven

The makers of the lathes, planers, cutters and special tools used in your present work and advertised in this paper use Stewart furnaces somewhere in the process of manufacture.

Ask them their experience

CHICAGO FLEXIBLE SHAFT CO.

CHICAGO, U.S.A.

RIVETED
STEEL TANKS

THE illustrations on this page are from photographs of the Fuel Oil installation built for the Steel Company of Canada, at Hamilton, Ont.

We build riveted steel tanks for every purpose, such as:—

OIL STORAGE, GASOLINE TANKS, AIR RECIEVERS, PNEUMATIC WATER SUPPLY TANKS, SMOKE STACKS, BOILER BREECHING, BINS AND HOPPERS.

Let us quote on your requirements. Heavy and Light Steel Plate Construction erected anywhere.

THE
TORONTO IRON WORKS
LIMITED
TORONTO

HEAD OFFICE:
ROYAL BANK BLDG.

WORKS:
CHERRY STREET

WM. W. HICKS

Manufacturers' Agent

WINNIPEG 567 Banning Street **MANITOBA**

MACHINERY
AND SUPPLIES

MACHINE Shops of Canada get quick and economical service by ordering from us. We handle the products of leading manufacturers.

Agents for

Garlock-Walker Machinery Co., Toronto — Wood-working and Metal-working Machinery.

Canadian Sirocco Co., Ltd., Windsor, Ont.—Ventilating Apparatus, Steam Traps.

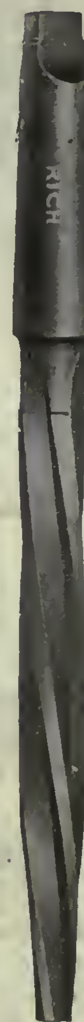
E. Leonard & Sons, London, Ont.—Boilers and Engines.

Main Belting Co. of Canada, Ltd., Montreal—Anaconda and Leviathan Belting.

Ric-Wil Co., Cleveland—Heat Insulating Products.

Falls Machine Co., Sheboygan Falls, Wis.—Automatic Engine Stops.

The Wm. B. Pierce Co., Buffalo, N.Y. —Dean Boiler Tube Cleaner and Hay's Gas Analysis Instruments.



Extra Big Stock of

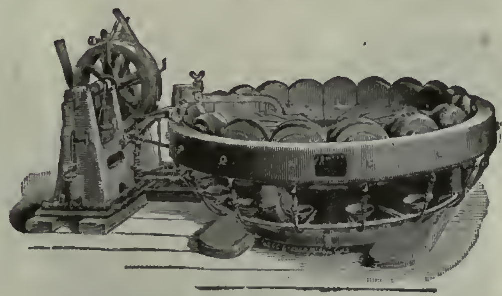
Leviathan and Anaconda Belting

Western Representative for

RICH HIGH SPEED DRILLS
REAMERS and CHUCKS

Stocked for Prompt Deliveries

THE WEST TIRE SETTER



The West Tire Setter, Tires, Wheels and Band Hubs

COLD

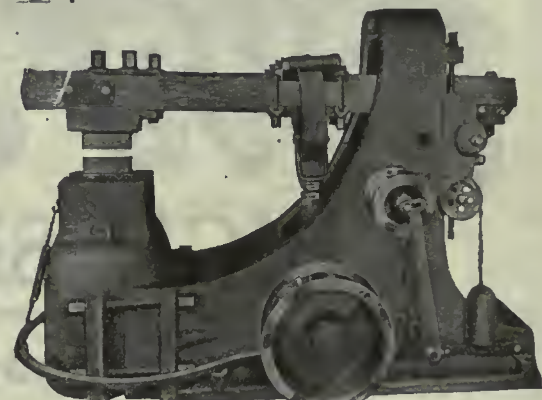
Saves time, labor and expense, increases the capacity of the shop, and **EARNS MONEY**

ANY TIME YOU SAY, we'll take up the matter with you and demonstrate the efficiency of our machines to your perfect satisfaction

THE ROCHESTER HELVE HAMMER

6 Sizes 2 Styles of Frames

Rochester Helve Hammers are adjustable for length of stroke while running, have non-crystallizable I-beam frames and separate, heavy weight anvils. Long stroke provides for handling larger work than other hammers of the same head sizes and the springy forging blows delivered by the solid hickory helves combine advantages of forging and drop hammers—do special die work which cannot be duplicated by hand.



EVERY MACHINE SHOP, WAGON SHOP, REPAIR SHOP WOULD BE WELL EQUIPPED WITH AN R.H.H.

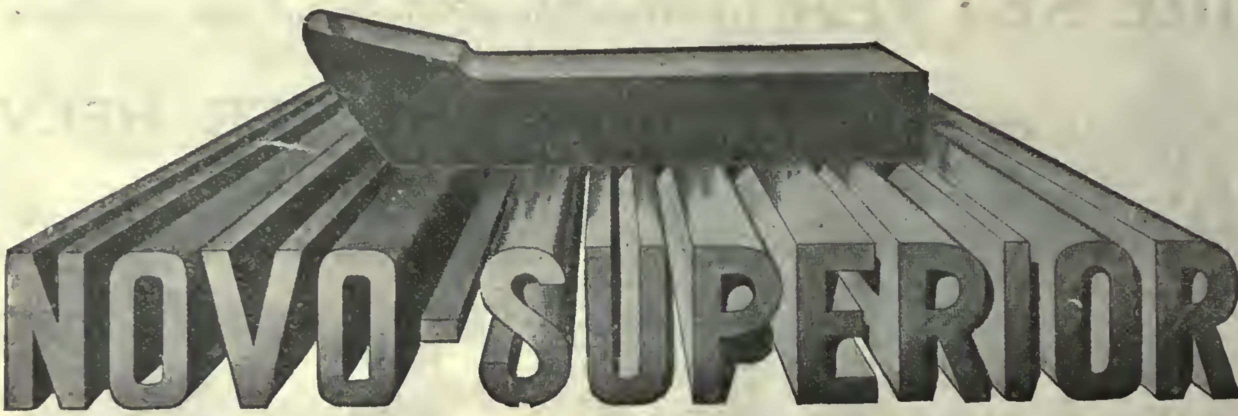
THE WEST TIRE SETTER CO., ROCHESTER, N.Y.

SEND FOR THE WEST TIRE SETTER CO. BOOKS ON THESE MACHINES.

When you walk through the plant and see a gang of men hauling and straining to move a heavy load, call to mind that this is the twentieth century, and get right in touch with

The Herbert Morris Crane & Hoist Company, Ltd., Niagara Falls, Canada

In anticipation of an early resumption of a large demand we are rapidly adding, and expect by the end of January next, to again have a large complete stock, as under pre-war conditions, of



HIGH SPEED STEEL

INTRA (Carbon-Tungsten Alloy) STEEL

Combining toughness with hardness.
Is unshrinkable as steel can be made.
Non-fussy to handle. Extra soft annealed.
Heat treatment same as any first-class straight carbon steel.
Suitable for taps, reamers, threading tools, blanking dies, punches, shear blades, gun snaps, etc.
If you want a steel that will give you from one and a half to three times the results of the best grades of straight carbon tool steel, try INTRA.

GIBRALTAR STEEL

Highest quality, straight carbon, crucible-made tool steel

ICO STEEL

For chisels, blacksmiths' tools, etc.

TOOL STEEL FOR EVERY PURPOSE

Hot and cold rolled carbon and high-speed tool steel.
For circular saws, springs, etc.

Cold rolled mild steel for shafting.

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, etc.
Music Wire for Springs, Steel Balls.
Circular Saws—for wood and for hot or cold metal cutting.
Machine Knives—for cutting wood, paper, tobacco, agricultural.

H. BOKER & CO., INC., 332 St. James St., Montreal, P.Q.

Sole Agents for Novo Steel Works, Sheffield, England


Dunlop
"Gibraltar
RedSpecial"
Power—Speed—Service
ON one of the largest main drives in Canada, "Gibraltar RedSpecial" reigns supreme.
It was selected on its record of past performances because the duties were exceptionally exacting.
Only such a high-power belt as "Gibraltar RedSpecial" could meet the demands in a case like this.
Used on thousands of other drives, too.
The Dunlop Guarantee
If you have a difficult drive anywhere in your factory drop a line to our Head Office, or to our nearest branch, and we will send a man experienced in belt engineering to consider your requirements. If it is an instance where "Gibraltar" Belting may be suitably employed we will recommend its use; and we will stand behind our recommendation with the fullest guarantee ever issued by a firm producing rubber products.
"The Original Red Rubber Belt."
Dunlop Tire & Rubber Goods Co., Limited
Head Office and Factories: TORONTO
Branches in Leading Cities.
Makers of Tires for all Purposes, Mechanical Rubber Products of all kinds, and General Rubber Specialties.
D.31a
RED GIBRALTAR SPECIAL
DUNLOP RUBBER BELTING
HONOR ROLL OF BELTING

A Projecting Set Screw Is a Menace!

It Puts Your Life in Danger

You may be working around the shaft, absorbed in the work you are doing, when, without warning, a projecting screw will get mixed up with your clothing and —you're in danger of losing your life. The projecting screw looks innocent enough, but it's a dangerous thing to get near when it's in a revolving shaft. This is no theoretical case. In Illinois, in one year, 100 men were killed or crippled for life due to set screw accidents. In fact, a law is now in effect in many states forbidding the use of projecting set screws on revolving shafts.

To positively prevent all accidents of the kind illustrated and to secure perfect set screw results, you should use

ALLEN SAFETY SET SCREWS

Made from special steel bars. Strong and well constructed. Will not mushroom in the hole. The hexagon hollow stays hexagon. It won't stretch and get out of shape. It stands all kinds of pressure. You can put your whole strength into turning the screw and not harm it in the least, though you *might* break the wrench. Allen Screws are always easy to take out. Nothing about them to wear.

Scientifically made. Every screw of a certain size, exactly the same. Made by a patented process, strengthening the metal over 30%, which together with their thickness at the point, makes them the strongest ever. They are quality screws, screws you should use if you want to prevent set screw accidents, troubles, delays and expenses.

Get Samples—Put Them to the Test.

We'll gladly send you samples which you can put to any strength test you want. The test will convince you that while you may have seen screws that **looked** like Allen screws, you have never seen any with their strength and pressure-resisting qualities. Write for catalog and price list.

The Allen Mfg. Co., 135 Sheldon St., Hartford, Conn.


NUMBER
4000
3800
2400
2200
INCREASED PRODUCTION


There's what good tools
did for us!
DUMORE
DUMORE
DUMORE HIGH SPEED GRINDERS

WELLAND SECTION

The City of Welland

is Forging Ahead

Twenty-five big industries of continental reputation have proved this during the last five years.

Every year in Welland is a record year—until the next one arrives. This is certainly true of the value of our manufactured products, which last year reached the astounding total of $28,642,390, an increase of very nearly fifty per cent. over the previous year, which, in turn, had shown almost as large a proportion of increase over the year 1915.

Do not these figures lend a new weight of proof to the common prophecy that the city of Welland is destined to be one of the first manufacturing cities of Ontario, and the zone of the Welland Ship Canal the **Workshop of the Dominion?**

Power Rates—Welland is the industrial hub of the Niagara peninsula where an unlimited amount of electric power is available and sold at competitive prices, owing to the numerous power companies represented there.

Every factory in Welland is driven by electric power supplied by the Ontario Power Company, of Niagara Falls, which is about twelve miles east of Welland, or from the Dominion Power Company of DeCew Falls, which is about twelve miles north of Welland. The fact that we have competitive companies operating in this district gives us competitive prices on power.

Cheapest Power in Canada

Unrivalled Rail Facilities

Lake Shipping Advantages

Lake Shipping: Welland is situated on the Welland Canal, the great marine highway, between tide water and the Canadian North-West, with daily freight service both ways.

Railroad Rates: Rates from Welland to the North-West and Pacific Coast, all rail, are the same as from all other manufacturing points in Eastern Canada lying between the Detroit River and Montreal. These rates are fixed by the Board of Railway Commissioners for Canada.

On account of the close proximity to the border, Welland is in the Buffalo switching group, and takes the Buffalo rates from the east and south, and enjoys quick delivery on all raw material imported from the United States.

The fact that all of these roads centre here creates competition, and is the biggest lever the manufacturers have for securing efficient service from the railroads.

The seven railroads are as follows: **Grand Trunk, Michigan Central, Toronto, Hamilton and Buffalo; Canadian Northern, Pere Marquette, Canadian Pacific, Wabash.**

LOUIS BLAKE DUFF

Industrial Commissioner

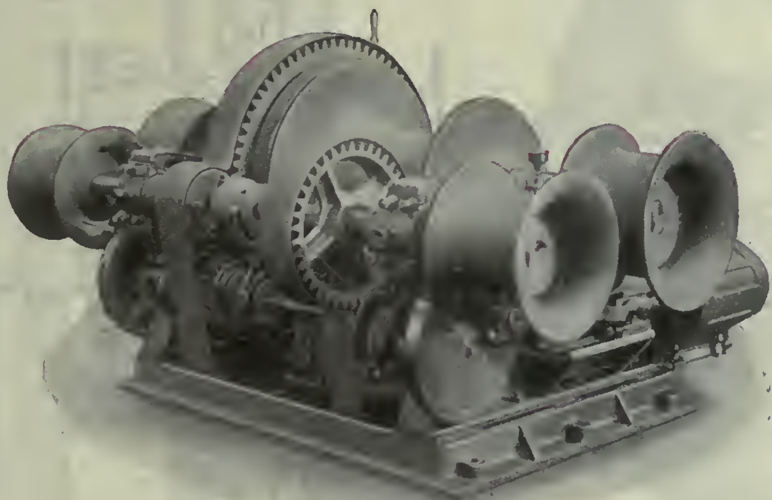
WELLAND CANADA

WELLAND SECTION

"BEATTY"

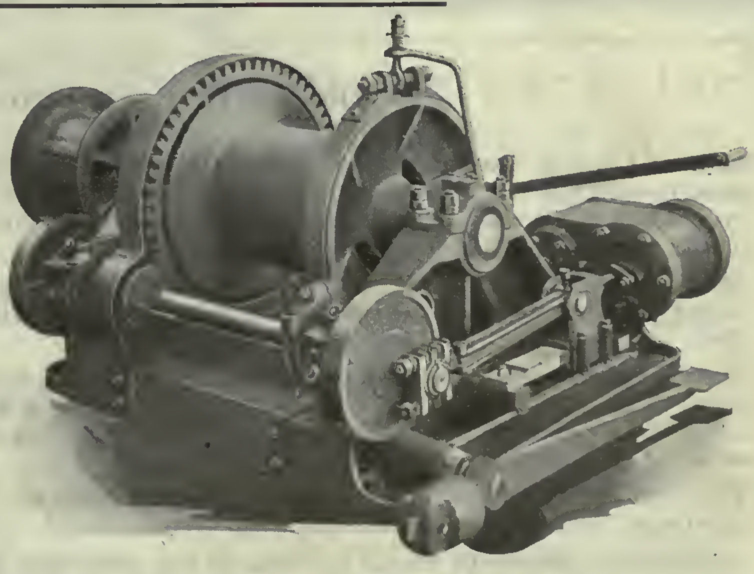
Deck Machinery for Ships

Anchor Windlasses, Ash Hoists, Cargo Winches, Etc.



7" x 12" double cylinder, double purchase Cargo winch with two whipping and two warping ends, as made by us in quantities for British ships built in Canada by the Imperial Munitions Board and other interests.

Machine embodies all latest improvements and is built throughout to jigs and templets.



8¼" x 8" double cylinder, single purchase, throttle reverse, cargo winch, being produced by us in large number for ships under construction by United States interests, and also adopted by numerous shipyards in Canada as standard for the vessels they are building here for French interests.

Send us your inquiries for this class of equipment.

OUR EXPERIENCE AND SHOP CAPACITY ENABLE US TO SERVE YOU ADVANTAGEOUSLY.

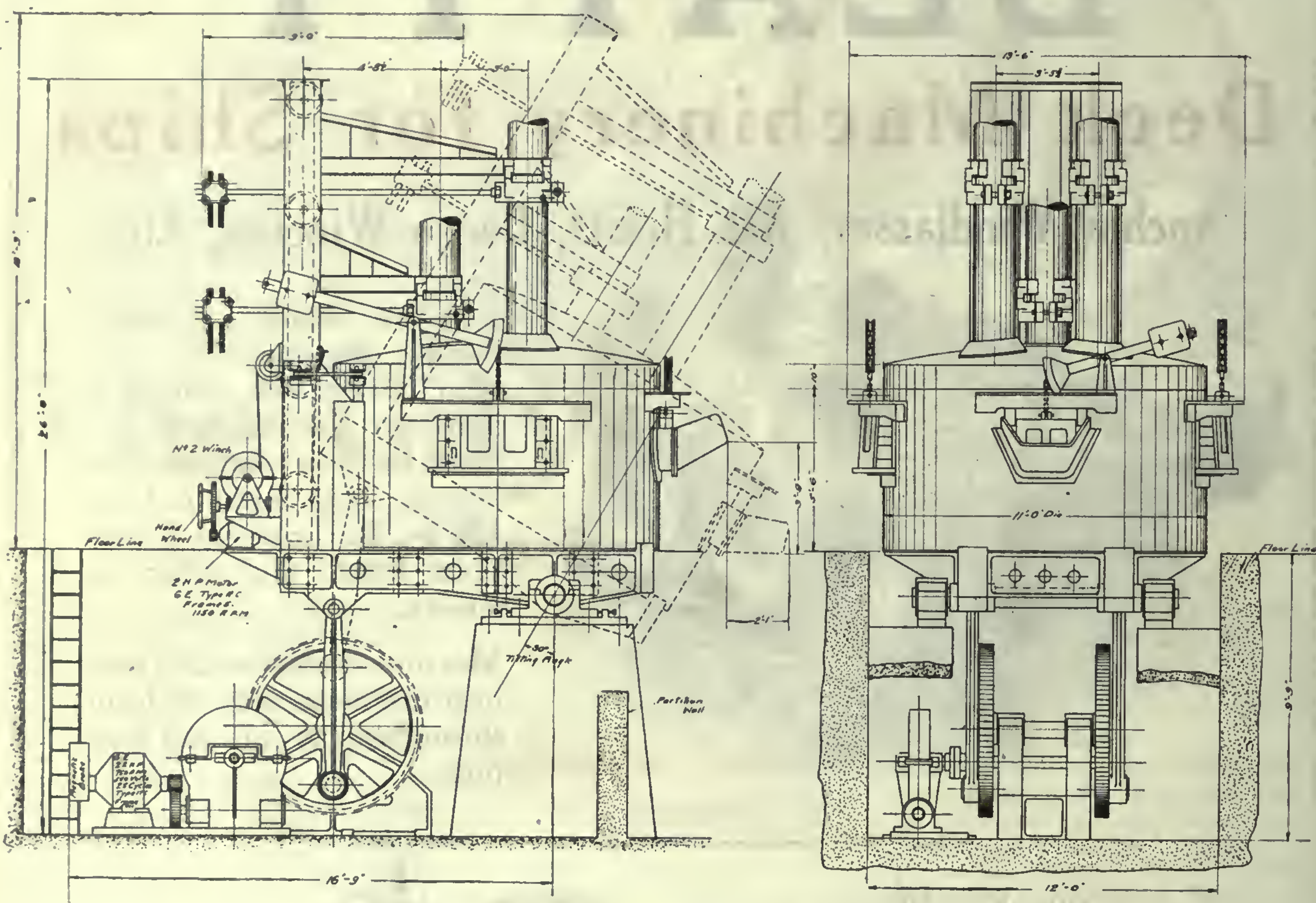
We also manufacture Steam and Electric Hoists, Dredges, Derricks, Clamshells

M. BEATTY & SONS, Limited
WELLAND, CANADA

Agents
H. E. PLANT, 1790 St. James, Montreal
R. HAMILTON & CO., - Vancouver
KELLY-POWELL, LTD., - Winnipeg
E. LEONARD & SONS, - St. John, N.B.

WELLAND SECTION

Volta Electric Steel Furnaces



6-TON 3-PHASE TILTING FURNACE

Sales of Electric Steel Furnaces during the period of the European War, for special steels and steel castings, have been phenomenal, the main reason being the superiority of electric steel over other steels and the adaptability of the electric furnace to use all kinds of scrap and practically no pig iron.

Steel specifications in the future will call for chemical and physical requirements in steel, which can be obtained in electric furnace practice with little additional cost over ordinary steel.

The furnace here shown is the result of close observation on our part of the many different types in operation since the first electric steel furnace was installed, and the criticism of different users of electric steel furnaces. It is in many respects equal and in a number of ways superior to any other type at present in use.

This furnace is simple, built of the strongest materials to ensure solidity, and will produce a maximum tonnage at a minimum power cost.

Prospective customers would do well to get complete information on this furnace, and our technical service, which we offer free, will be of material assistance in working out the various details which occur in connection with electric furnace installations.

Volta Manufacturing Company

Welland - Ontario


Wilt Twist Drills
Were in it From the Start
THEY helped in the accurate and speedy production of munitions of every kind. In the manufacture of shells, aeroplanes, motor trucks, tanks, machine guns, rifles and marine equipment: WILT TWIST DRILLS measured up to the highest standard of efficiency.
The Message of To-Day
Is Again
Courage and Conviction
Let this be the watchword of the reconstruction period. Industry will continue to demand tools of quality, and as before WILT HIGH SPEED AND CARBON TWIST DRILLS will be required for WORLD-WIDE SERVICE.
Drills of quality that met the stress and strain of war will be in greater demand during times of peace.
"Where There's a Wilt—There's the Way."
WILT TWIST DRILL CO.
OF CANADA, LIMITED
Walkerville Ontario Canada
London Office : Wilt Twist Drill Agency, Moorgate Hall, Finsbury Pavement, London, E.C. 2, England
WILT

ALTERNATING CURRENT ARC WELDER

Highest Efficiency with Lowest Operating Cost

The Latest Practical Development in Arc Welding

"MEPHISTO" WELDER

Portable. No moving parts. No wearing parts. No up-keep cost. Does not require expert to operate. No pre-heating except on cast iron. Welds easily machined.

Wide range of amperage, 40 to 200 permits welding of materials from 16 gauge up.

The Arcwell Corporation of Canada, Ltd.
710 C.P.R. Building, Phone Adelaide 1341, Toronto

U.S. Office: 42 Broadway, New York City

"WACO"

TRADE MARK

"WACO"

TRADE MARK

High Speed Steel

"Double Waco" Quality—for Quick Production Work

"Turtle Brand"—High-class Tool Steels, Files, Drills, etc.

MANUFACTURED BY

WM. ATKINS & COMPANY, LIMITED

RELIANCE STEEL WORKS Established 1870 SHEFFIELD, ENGLAND

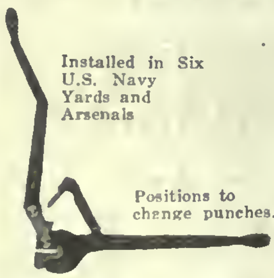
Sole Representatives for Canada

GEO. A. MARSHALL & CO.

1118 Queen Street West, Toronto, Ontario

Phone Park. 250

Uncle Sam Operating Hundreds



Installed in Six U.S. Navy Yards and Arsenals

Positions to change punches.

Best by Ten Years' Test. Nearly 17,000 in Use. Simplest Construction.

Fewest Parts. Drop Forged.

Only Portable Channel Iron Punch on Market. Capacity ¼ through ¼ Iron. Punches to center of 4 inch Channel Iron, with 1½ inch flanges. All parts Interchangeable with No. 2 Punch.

Takes the place of an extra man. Allows work to be done anywhere, with or without vise. Frequently pay for themselves on one job.

THREE STYLES

No. 2

Capacity; 5-16-inch hole through ¼-inch iron. Weight: 14 pounds. Length over all, 23 inches.

No. 1

Capacity ⅜ through ¼ iron.

Labor Saving Money Making Tools

Ask your Jobber or write us for Prices and Recommends.

W. A. Whitney Mfg. Co., Rockford, Ill., U.S.A.

Increased Production Means Increased Profits

Large Millers for large work —STEPTOE MILLERS for small work

Large Planers for large work —STEPTOE SHAPERS for small work.

Will result in increased production; less money invested in machinery, and increased profits.

THE JOHN STEPTOE COMPANY

CUMMINSVILLE, CINCINNATI, OHIO, U.S.A.

Canadian Representatives: Garlock-Walker Machinery Co., Toronto, Ont.

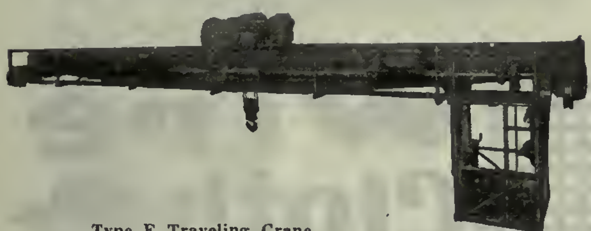
NORTHERN CRANES

NORTHERN CRANE WORKS LIMITED
WALKERVILLE, ONTARIO

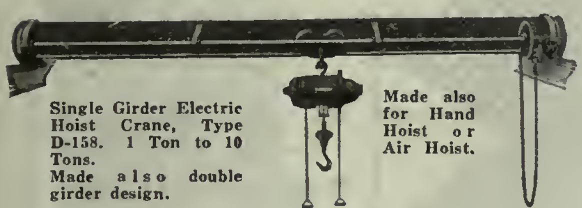
Three Motor Patent Type E Crane

Type D Electric Hoists —½ to 10 Tons.

Special Monorail Transfer Traveling Crane.



Type E Traveling Crane



Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons.
Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Buy Northern Cranes Made in Canada!

It is not necessary to go outside of Canada for good cranes and hoists. Our modern crane plant at Walkerville can take care of your crane needs.

Whether you require electric or hand cranes, we have modern designs. We also make electric hoists, air hoists and foundry equipment.

Electric Traveling Gantry Crane with Magnet

Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada. All gears enclosed and non-overhung

NORTHERN CRANE WORKS, LIMITED
WALKERVILLE, ONTARIO, CANADA


FILES
IMPERIAL
TRADE MARK
PXH
TRADE MARK
PXH
TRADE MARK
Canadian Standard
DO IT FOR CANADA
Reconstruction has no terrors for Canada. Confidence in the present and faith in the future are all that are necessary to carry us through this period.
But—we must buy Canadian products ourselves whenever possible, and encourage others to do so.
This company pledges itself to do that.
There is a Canadian File for every Canadian job, and if we all strive to produce there will be plenty of Canadian jobs now and for all time.
DO IT FOR CANADA
"They Cut Faster and Wear Longer"
Port Hope File Manufacturing Company
Port Hope, Ontario

TREMENDOUS STRENGTH

PLUS *uniform wear in every square inch*

LEVIATHAN
ANACONDA

the BELTS that are

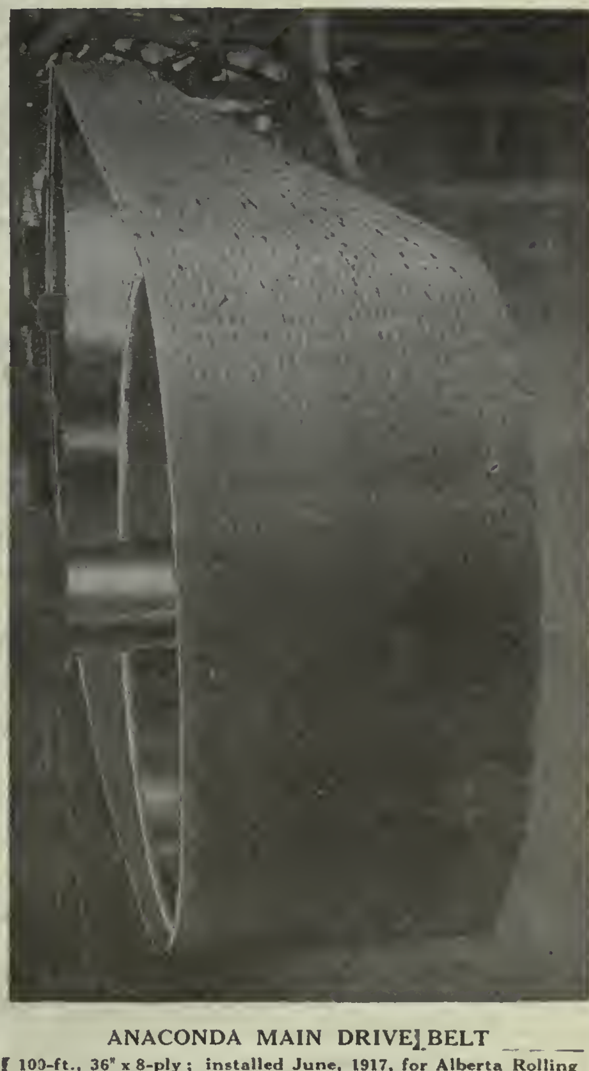
"Built to Fit"

any load—and in each application specifically adapted to *exact needs.*

MAIN BELTING COMPANY
OF CANADA, LIMITED
10 ST. PETER ST.
MONTREAL

TORONTO
32 Front St. West

WINNIPEG
567 Banning St.



ANACONDA MAIN DRIVE BELT
100-ft., 36" x 8-ply; installed June, 1917, for Alberta Rolling Mill Co., Ltd., Medicine Hat, Alberta.
Photographed November, 1918.

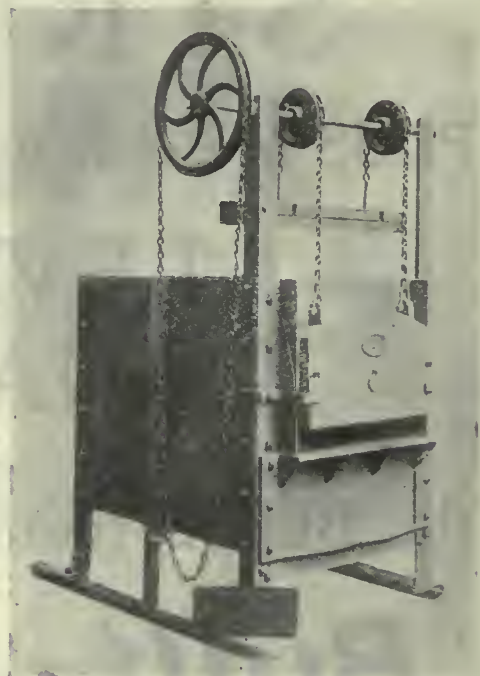
Do These Advantages Appeal

To Your Sense of Economy and Efficiency?

OIL FURNACE
VERSUS
COAL FURNACE

It's economy — requires one-half the space; costs less than half; no chimneys or flues required; instantaneous and perfect control of temperature; higher temperature obtained; no coal ash handlers required; no coal or ash piles; less waste of fuel, because it is shut off instantly; requires much less time to get the required heat. *Can you afford to lose the Advantages of this oil Furnace?*

Write To-day for Full Particulars.



Mechanical Engineering Company,
Limited
55 Cote Street
Montreal Que., Canada
PHONE MAIN 3585
Cable Address: *"Mecol"*

STANDARD FURNACES

OIL or GAS

Prompt delivery on all tool room types

FORGING FURNACE

For
- Annealing
- Carbonizing
- Hardening
- High Speed Steel
- Lead and Salt
- Oil Tempering
- Forging
- Riveting
- Shell Types

TORONTO OFFICE:
Standard Fuel Engineering Co.
W. H. KIRK, Manager
909 Excelsior Life Building
Phone Main 385

STANDARD FUEL ENGINEERING CO.
DETROIT, MICH.

The Lancashire Dynamo & Motor Company, of Canada, Limited

49-63 Niagara Street, TORONTO

ELECTRICAL MACHINERY for all Purposes.

ELLIOTT BROS'. { INSTRUMENTS / RECORDING GAUGES

PIPE VENTILATED A C MOTOR
FOR VERY DIRTY PLACES

PLUMBING, BUILDERS and HARDWARE

GREY THE K–T F'D'Y IRON

Trade K—T Mark (KA—TIE)

CASTINGS

These are our SPECIAL LINES. But at this time we are prepared to handle contract work up to 15 tons per day. For gated pattern, match plate, stripping plate, machine and repetition work of any kind we are prepared to quote you most attractive prices and prompt delivery.

Would You Like to Know

the analysis and physical test of metal in your castings? How they could be made cheaper? What properties of metal would facilitate your finishing operations or improve their quality?

ASK US

THE KATIE FOUNDRY

GALT - ONTARIO

Swedish Steel & Importing Co., Limited

Montreal, New York — Toronto, Denver

Direct representatives of foremost Swedish mills: makers of

Tool Steels

ALLOY STEELS, BILLETS, BARS, DISCS, SHEETS, HIGH SPEED STEELS, DRILL RODS, DRAWN BARS, SEAMLESS TUBING, COLD ROLLED STRIP STEEL, WELDING WIRE, WROUGHT AND ROLLED IRON, PIG IRON, STEEL AND IRON ENDS, HOLLOW AND SOLID MINING DRILL STEEL.

TRADE MARK SS "DOUBLE ESS"

PROMPT SHIPMENTS from large stock

Electrite Uranium High Speed Steel

Electric furnaces, automatically regulated, the most modern methods, and the introduction of Uranium — make this a steel of truly remarkably cutting properties.

We know "Electrite" cannot be bettered — and stand ready to prove it to you.

LATROBE ELECTRIC STEEL CO.

LATROBE, PA.

URANIUM

HIGH SPEED STEEL

Time Spent Grinding Tools Is Wasted Production Time

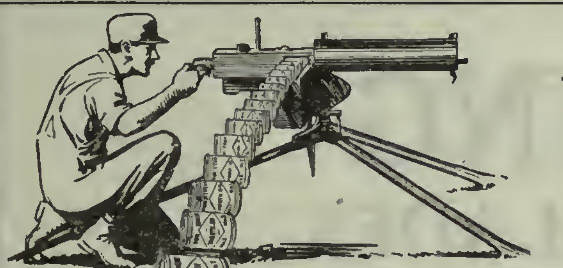
The great strength and toughness of Uranium Steel—the stamina that enables its cutting point to stand up under repeated shocks and strains without frequent grindings accelerates production.

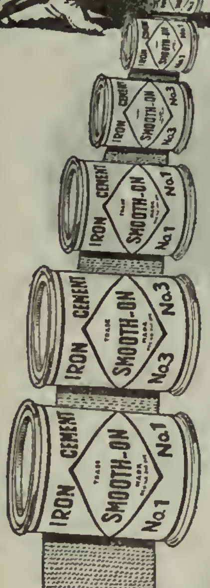
For time spent grinding tools is wasted production time.

Uranium High-Speed Tools make few trips to the grindstone.

Try it out for yourself.

STANDARD ALLOYS COMPANY
FORBES AND MEYRAN AVES.
PITTSBURGH PENNA.





Strongly Armed

for the emergencies, when a quickly-made **but lasting** repair is needed.

SMOOTH-ON Iron Cements

are the first choice of thousands of engineers, for leaks of steam, water, gas or oil.

For Sale by Supply Houses

SMOOTH-ON MANUFACTURING CO.
ESTABLISHED 1895
570-574 COMMUNIPAW AVE., JERSEY CITY, N. J. U.S.A.

Peerless HIGH SPEED

THE NEW STANDARD

Increases Production 50 to 100%

Why Not?

WHEN big plants of national reputation, who are using three, six, eight, twelve and up to thirty or more Peerless Machines say that they increase production from 50 to 100 per cent., saving in time, labor, blades and expensive material;

AND WHEN we are willing to have you try out the Peerless for 30 days' at our own risk and expense, we paying freight both ways if it fails to make good;

THEN WHY NOT try it out for yourselves, when the gain is more yours than ours if it makes good, and if it fails the loss is ours alone?

PEERLESS MACHINE CO.
1607 RACINE STREET RACINE, WISCONSIN

FOR HARDNESS TESTING

of Shells and Other Munition Materials

THE STANDARD SCLEROSCOPE

is now universally used. It is direct reading as a thermometer and makes 5,000 tests a day. It does not leave marks on the finished work and can be operated by unskilled labor. Send for 80-page booklet free.

THE PYROSCOPE FOR HEAT TREATMENT

Is the common-sense heat measuring instrument that makes straight for results without fuss. Costs least of all; burns simple kerosene; never varies. It is the one available trusty in the grimy hands of furnace men, hardeners, carburizors, and is also being universally adopted by colleges owing to the correctness of the principle utilized. Our best customers are those who have tried all other means of heat measuring.

Send for Our Free Circular P.

The Pyroscope in use

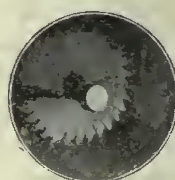
SHORE INSTRUMENT & MFG. CO., INC.

555-557 West 22nd Street, New York

Agents in all Foreign Countries

Sales Agents:

The A. R. Williams Machinery Co., Limited, Toronto, Canada



"STERLING"

HACK SAW BLADES

A brand once adopted, difficult to replace.

REASONS—High quality of material used, mechanical construction, and special heat treatment.

RESULTS—Economy, which means satisfied customers.

Write for information and prices.

DIAMOND SAW & STAMPING WORKS

BUFFALO, N.Y., U.S.A.

PRESS ADVERTISING SOLD VICTORY BONDS

BEFORE the war, bond buyers were "marked men." In number they were 40,000 in March, 1917 — this is shown by the number of purchasers of the Government War Loan of that date. But in the autumn of the same year, their number increased twenty times — to 820,000! This was the number purchasing the Victory Loan, 1917. Last month—November, 1918—over 1,000,000 persons purchased the Victory Loan, 1918!

These wonderful results were accomplished by Press Advertising.

Before the war one-half of one per cent. of our people bought bonds. Now quite twelve and one-half per cent. of our people are bond buyers!

Before the stupendous amount of $676,000,000 worth of bonds could be sold to our Canadian people in three weeks a most thorough and exhaustive campaign of education was necessary, and this campaign was carried through by advertising in the public press. The power of the printed word never had a more convincing demonstration.

By means of the printed word, through the medium of advertisements in the press of our country, the Canadian people were made to know what bonds are, the nature of their security, their attractiveness as an investment, and why the Government had to sell bonds.

Every point and feature of Victory Bonds was illustrated and described before and during the campaign—in advertisements. No argument was overlooked. No selling point was neglected.

The result is that Canadians to-day are a nation of bondholders.

They know what a convenient, safe and profitable form of investment bonds are. Instead of one man in two hundred owning bonds, now one Canadian in eight—men, women and children—owns a Government Security.

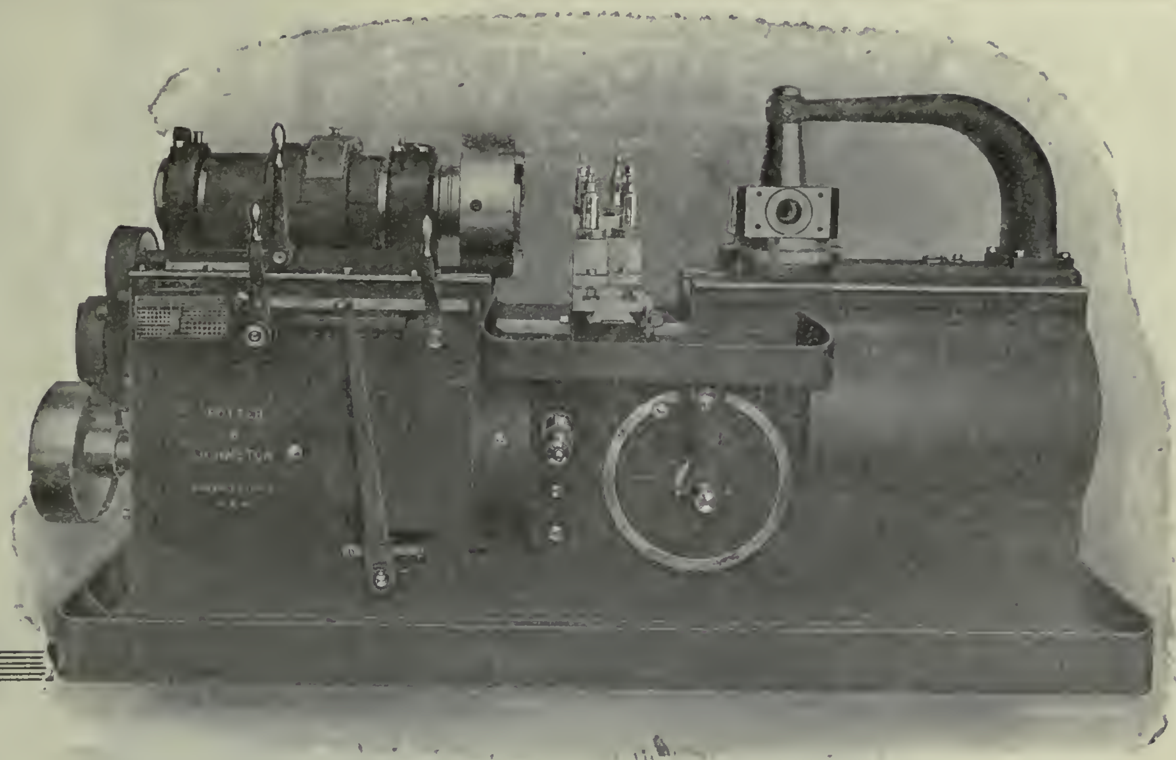
This complete transformation in the national mind and habits was brought about by advertising in the press of the nation. Press advertising has justified itself as the surest and speediest method by which a man's reason can be influenced and directed.

The Minister of Finance acknowledges this. His own words are:

> *"The wonderful success of the Loan was due in large measure to their (the press of Canada) splendid and untiring efforts during the whole of the Campaign."*

Mr. E. R. Wood, Chairman of the Dominion Executive Committee having oversight of the campaign to raise Victory Loan, 1918, said, " . . *The press publicity campaign . . . . will rank as one of the most remarkable and efficient publicity campaigns ever undertaken in any country,"* and Mr. J. H. Gundy, Vice-Chairman of the same committee, said: *"I have been selling bonds for a long time, but I never found it so easy to sell them as at this time. The reason is the splendid work the press has done. I take off my hat to the press of Canada."*

The success of Victory Loan, 1918, and the knowledge which Canadians now possess of bonds are a straight challenge to the man who doubts the power of the printed word, in the form of advertisements, to sell goods—and this applies not to bonds alone, but to the goods *you* are interested in selling.



6-A Potter & Johnston Automatic Chucking and Turning Machine

6-A Potter & Johnston Automatic Chucking and Turning Machine

Geared head, having three automatic changes of spindle speeds.
Geared feed.
Auxiliary reaming and threading feed.
Cross slide.
Automatic back facer bar through spindle.
16-inch convertible two and three-jaw scroll chuck.
Spindle $5\frac{3}{4}$ inches diameter, hole $3\frac{1}{2}$ inches diameter.

Increased output means reduced cost, *both* are readily obtained on

Potter & Johnston

Manufacturing Automatics

DO IT AUTOMATICALLY

All operations are entirely automatic. One attendant can readily run a battery of two to six machines.

In addition to automatically machining all varieties of castings from iron, bronze or steel, also forgings, the machines are also recommended and are widely used for finishing pieces from bar starch which have previously been cut off to length. This is a highly economical method of producing gear blanks, bushings, studs, etc.

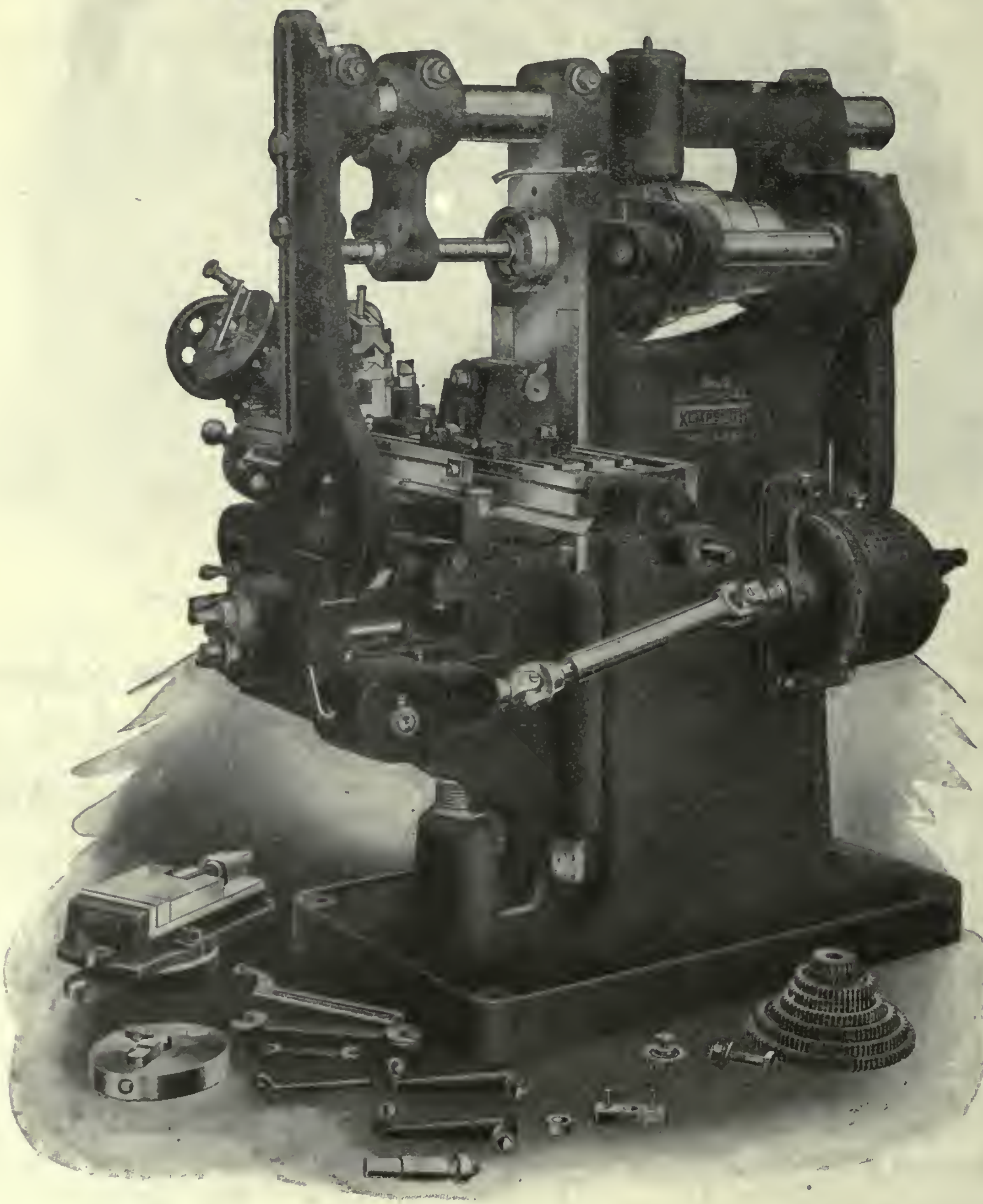
Catalog gives full particulars. Drop a card for it.

Canadian Offices : POTTER & JOHNSTON MACHINE CO., Pawtucket, R.I.

ROELOFSON MACHINE & TOOL CO., LTD.

Head Office : 1501 Royal Bank Building, Toronto, Canada
Works and Warehouse : Galt, Ont., Canada

KEMPSMITH



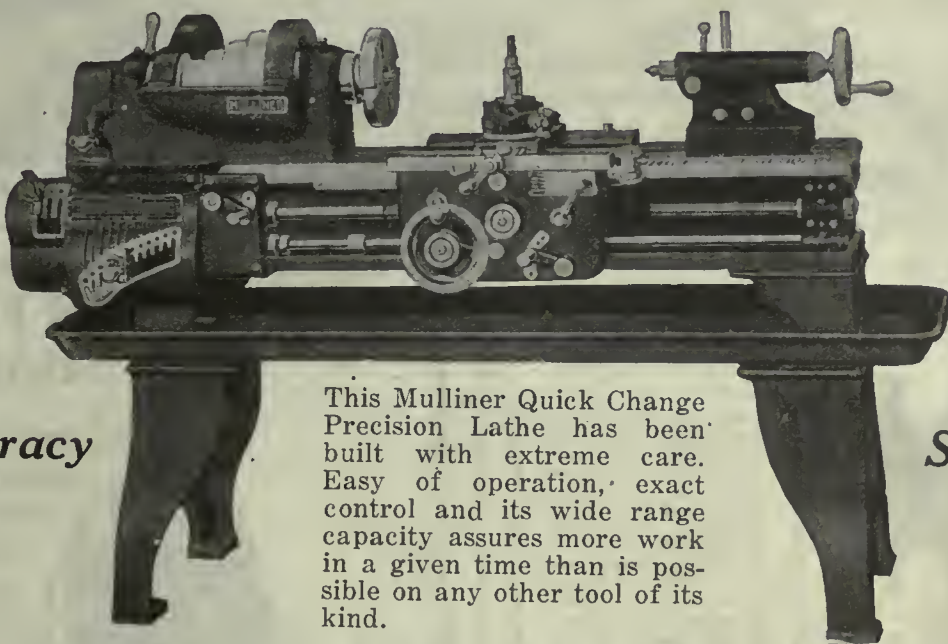
The Kempsmith Miller enjoys a reputation for performance second to that of no other miller on the market. It is made in a long-established, well-organized and thoroughly modern plant devoted exclusively to the manufacture of Kempsmith Millers and Attachments.

It is sold with an iron-clad guarantee.

THE KEMPSMITH MANUFACTURING CO.
MILWAUKEE, WIS., U.S.A.

MULLINER

The Quick Change Lathe with 37 Different Threads and Feeds



Accuracy

Speed

This Mulliner Quick Change Precision Lathe has been built with extreme care. Easy of operation, exact control and its wide range capacity assures more work in a given time than is possible on any other tool of its kind.

Special features have been incorporated into Mulliner Quick Change Lathes which permit an absolute guarantee of accuracy to within .001" in boring and turning, and quick change mechanism provides 37 different threads and speeds.

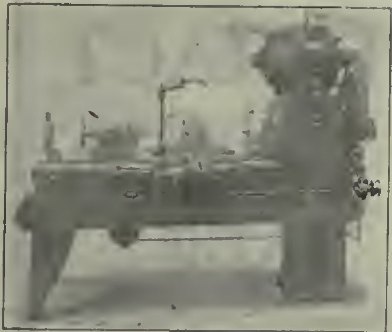
The specially designed tumbler gears insure absolute minimum of wear, there being no clashing, when the gears engage. This allows for greater speed. The absolute lack of all superfluous mechanism is another feature that promotes speed. Sizes 12" to 14" with 4", 5" or 6" bed.

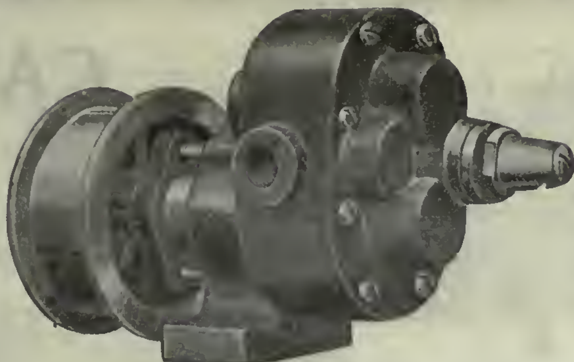
Mulliner-Enlund Tools are built for speed, for accuracy, for economy in operation. Pleased to tell you more about them.

MULLINER-ENLUND TOOL CO., Inc., SYRACUSE, N.Y., U.S.A.

Canadian Representatives:

H. W. Petrie, Limited, Toronto, Ont. **The Geo. F. Foss Machinery & Supply Co., Limited, Montreal, Que.**





TRAHERN

Rotary Geared Pumps to Suit all Requirements

Does the cutting tool on your metal working machine require a stream of 1½ or 75 gallons per minute? Whatever may be the need the many styles and sizes of Trahern Rotary Geared Pumps will fill it.

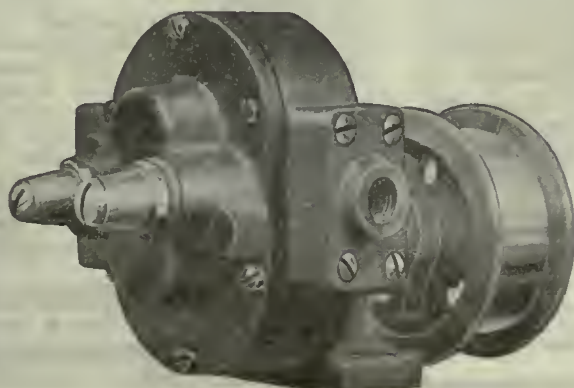
TRAHERN ROTARY GEARED PUMPS will measure up to the most exacting standards of pump efficiency. The accurate machining and perfect adjustment of TRAHERN pumps render the possibility of clogging or loss of prime a negligible factor. They will work with or without pressure—thus performing the functions of both the rotary and centrifugal types.

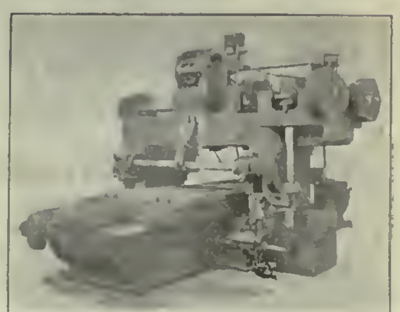
Write for our free booklet—it will tell you all about them.

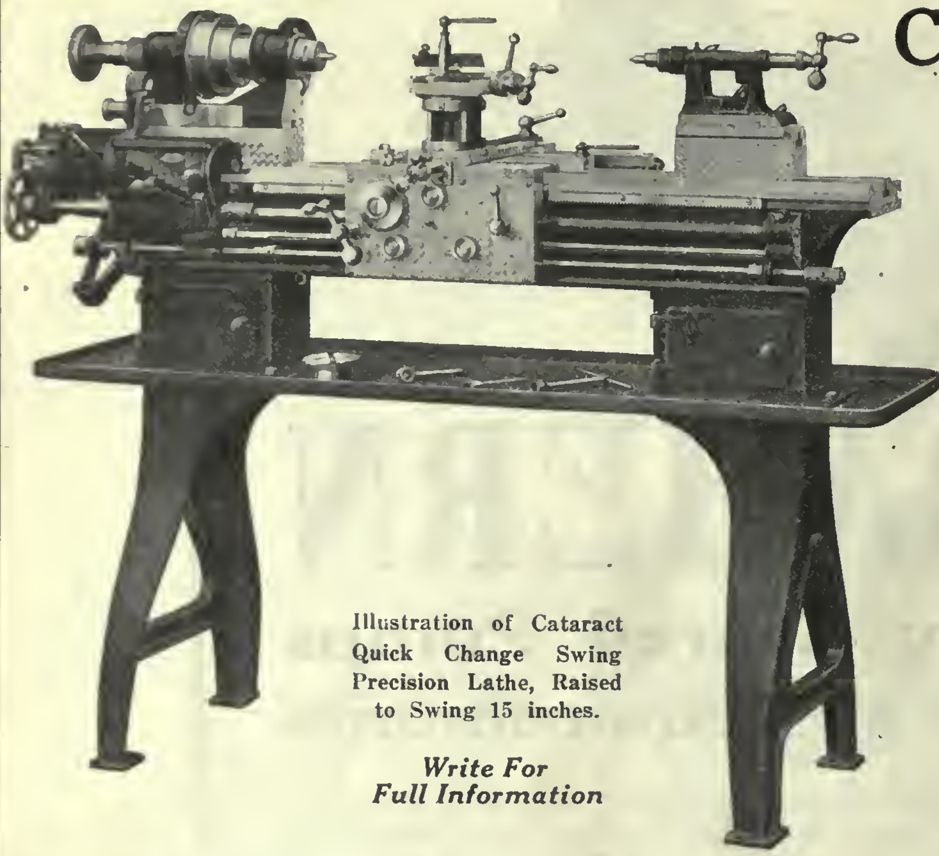
TRAHERN PUMP COMPANY

Rockford, Illinois

Represented in Canada by A. R. Williams Machinery Company







CATARACT

QUICK-CHANGE PRECISION LATHE

Ideally designed for both ordinary and specially fine work. This Cataract lathe has accomplished so much in so many plants we'd particularly like YOU to know all the particulars of its unusual record.

Length of Bed ....52"
Total Length of Lathe ......65"
Distance Between Centres...28'
Swing ....9" and 15"
Swing over Carriage 5½" and 11½'
Diameter of Lead Screw 1" x 6 pitch
Diameter of Front Cover.2 1-32"
1 Diameter of Rear Bearing 1⅛"
Length of Spindle ....15"
Hole through Spindle......1¼"
Draw-in Chuck Cap.1" maximum

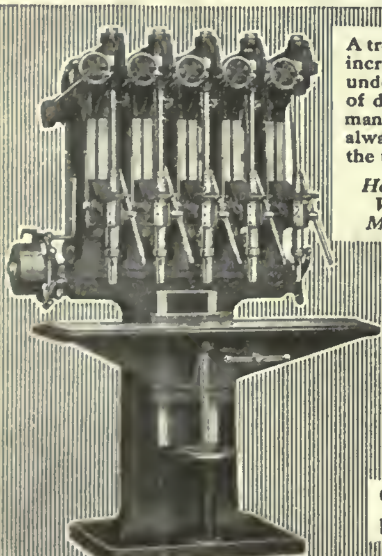
Illustration of Cataract Quick Change Swing Precision Lathe, Raised to Swing 15 inches.

Write For Full Information

Hardinge Bros., Inc.
1770 Berteau Avenue
Chicago, Ill., U.S.A.

HENRY & WRIGHT

Drilling Machines

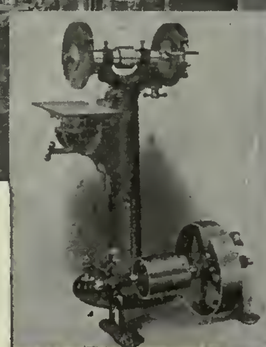


A tremendous increase in the understanding of drilling for manufacturing alwaysfollows the use of all *Henry and Wright Machines*

Class K
Number 5

The Henry & Wright Mfg. Co.
Hartford, Conn.

Canadian Fairbanks-Morse Co., Montreal, Toronto, Winnipeg; A. R. Williams Machinery Co., Toronto, St. John, N.B.; H. W. Petrie, Ltd., Toronto; Williams & Wilson, Montreal; Rudel-Belnap Machinery Co., Montreal; Canada Machinery Corp., Galt, Ont.; Geo. F. Foss Machinery & Supply Co., Montreal; General Supply Co., Montreal.

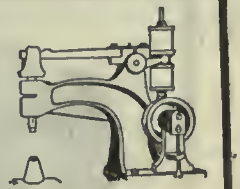


WE BUILD THEM BY HUNDREDS

Standardized Production enables us to offer this powerful Waterbury Grinder at such a low price. It grinds rapidly and accurately, all flat surfaces, dies, punches, planer, lathe, and other tools. Has adjustable table and tool rest with large radius of travel. Rigid, 3-point table supports giving great steadiness. A reliable, practical grinding outfit.

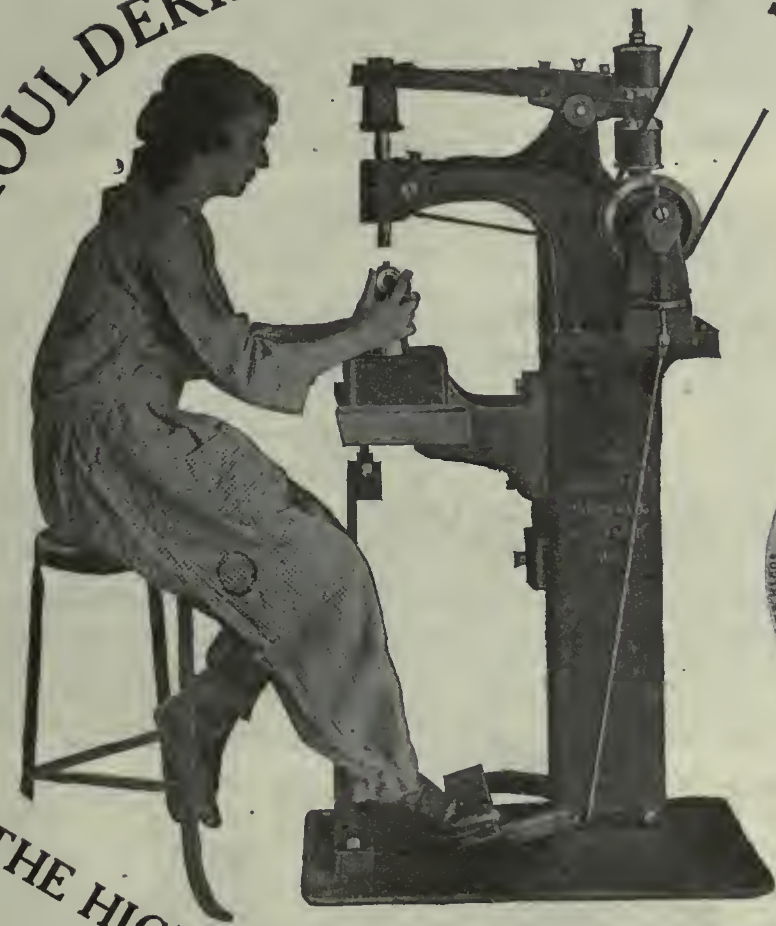
The Blake & Johnson Co., Waterbury, Conn.

THE PRINCIPLE IS RIGHT
THE HAMMER WITH THE HUMAN STROKE



SHOULDERING THE WORLD'S RIVETING

THE HIGH SPEED WAY; DOING THE WORK OF FOUR HAND RIVETERS



THE HIGH SPEED HAMMER COMPANY, Inc.

ROCHESTER, N. Y., U. S. A.

The High Speed Hammers
HEAD RIVETS COLD

Tight or Loose, Flush or Countersunk or Finishes Heads Any Shape Desired at the rate of:

A Rivet a Second up to 3/16"
A Rivet in 2 Seconds, ¼" to ⅜"
A Rivet in 3 Seconds, 7/16" to ⅝"

BUILT IN 8 SIZES

Send for High Speed Hammer Book

HIGH SPEED DRILL PRESS

MODEL E-50 HIGH SPEED
MOTOR-DRIVEN
BALL-BEARING

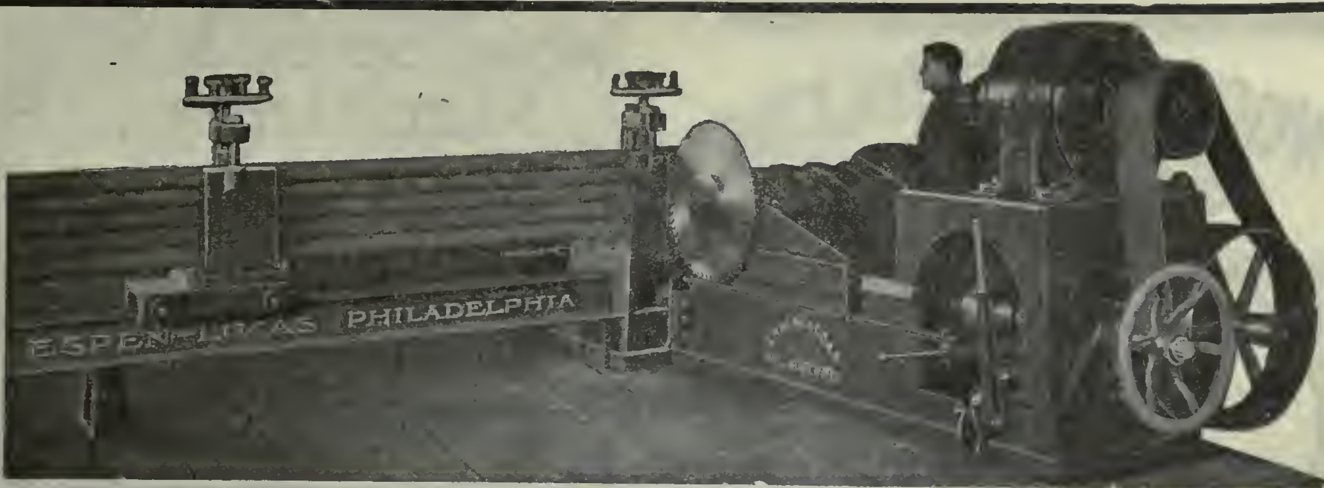
Sensitive Bench Drill Press

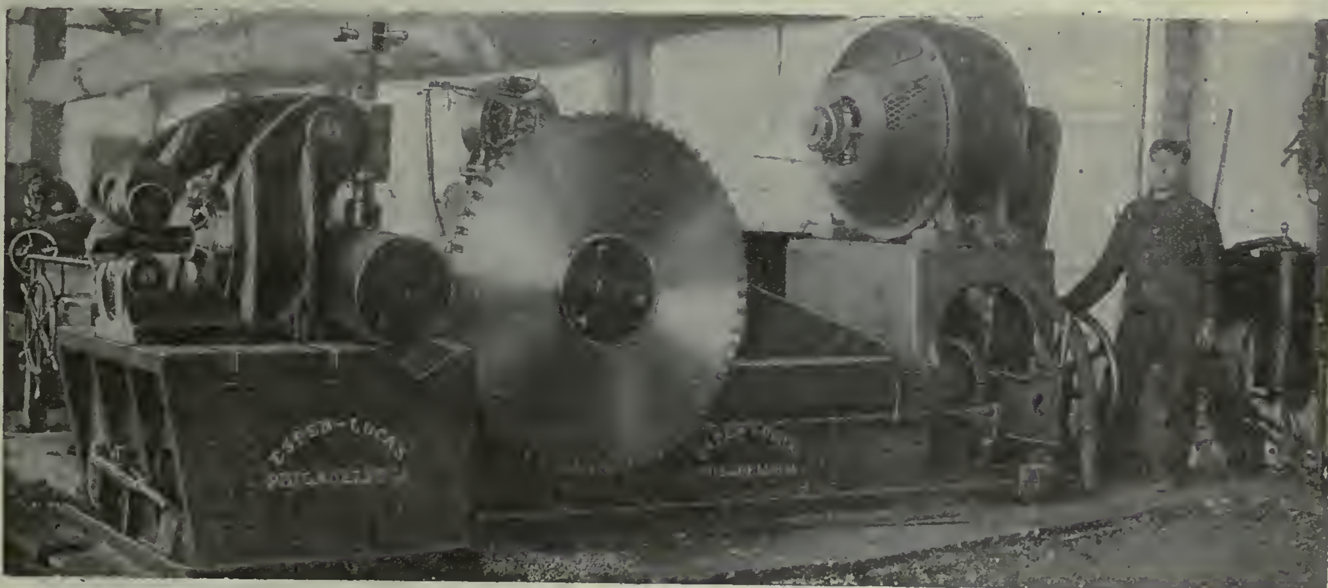
SPECIFICATIONS:

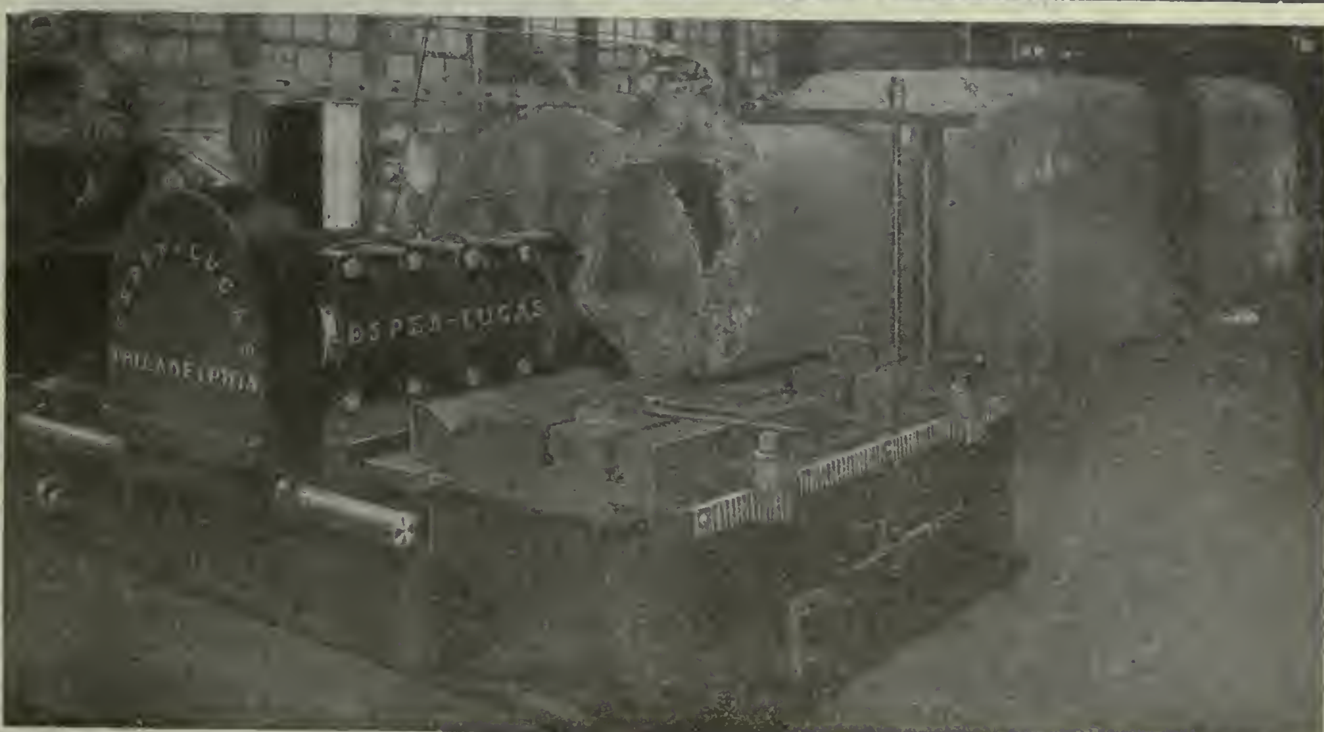
Height Over All	24"
Base	7½x18"
Diameter of Spindle	7/16"
Spindle Feed	2¼"
Weight	62 lbs.
Capacity	From Smallest to 3/16" Drills

Send for High Speed Hammer Book

Exclusive Arrangements Considered Only With Organizations Prepared To Carry, At All Times, Representative Stocks


ESPEN-LUCAS PHILADELPHIA




PHILADELPHIA
ESPEN-LUCAS

WINNIPEG IRON FOUNDRY

Castings of All Descriptions

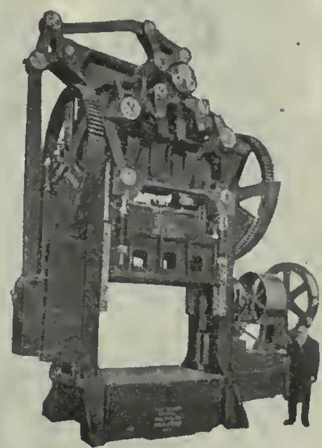
Our plant is well equipped to meet all your requirements for Iron Castings.

Let us make your patterns and Machinery repairs too. Quick service. Get in touch with us.

Winnipeg Foundry Company, Ltd.
Winnipeg Man.

The "TOLEDO" Toggle Drawing Presses

Producers that are solving many present-day problems. The practical effectiveness of the simple toggle movement — the perfect timing, ease of control and smooth performance are the reasons for their wonderful success.



Built single and double crank in 80 sizes, weighing from 7,500 to 750,000 lbs., and adapted to work from tin cups to the most difficult special forms and shapes.

The Toledo Machine & Tool Co.
TOLEDO, OHIO

Representatives—Allied Machinery Co. of America, 19 Rue de Rocroy, Paris, France; Via XX Settembre 12, Turin, Italy; 16 Seidengasse, Zurich, Switzerland.

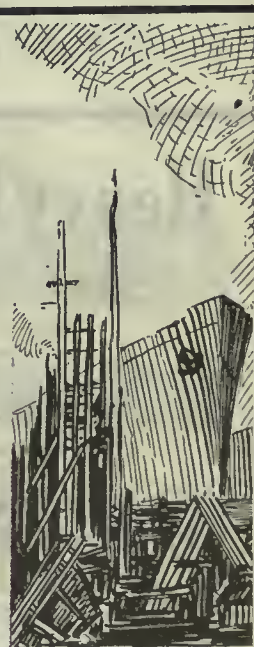
Tolland Mfg. Company
LIMITED

1167 Carrieres Street
Montreal, Que., Can.

Engineers Brass and Iron Founders and Machinists

Specially Equipped for Repetition Orders of any kind or size

All enquiries will be promptly answered—Write to-day



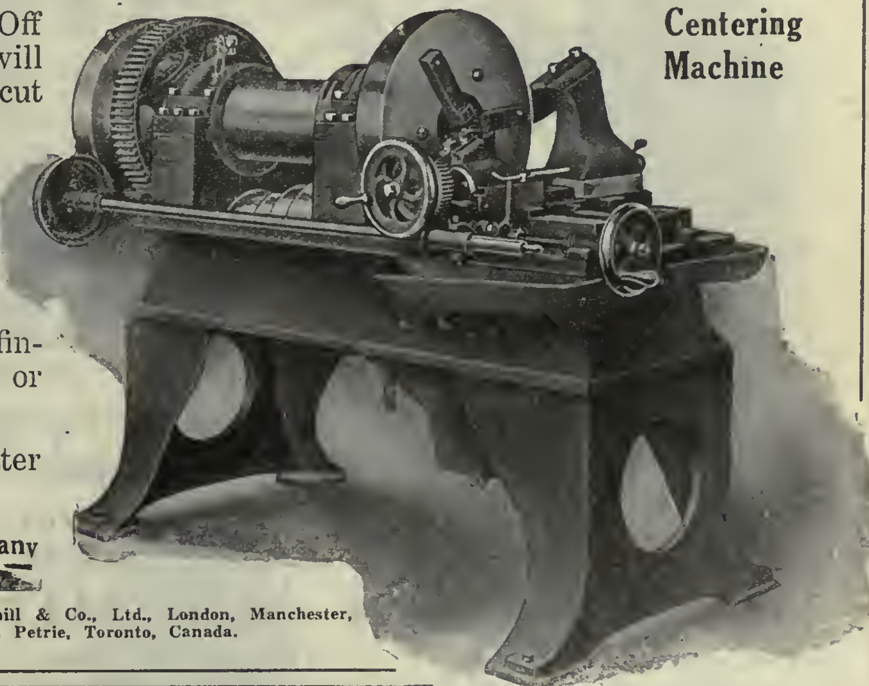
CASTINGS ROUGH or MACHINED **CASTINGS**
IN
GREY IRON, COPPER, GUN METAL, ANTI-ACID METAL, BRONZE, RED BRASS, YELLOW BRASS, BRAZING METAL, SPECIAL BEARING METAL, ALUMINUM AND MARINE CASTINGS.

Manufacturers of the Celebrated TOMCO BEARINGS

Single Machine With the Capacity of Two

HURLBUT-ROGERS
Cutting-off and Centering Machine

The Hurlbut-Rogers Cutting-Off and Centering Machine will double your production and cut your costs in half.

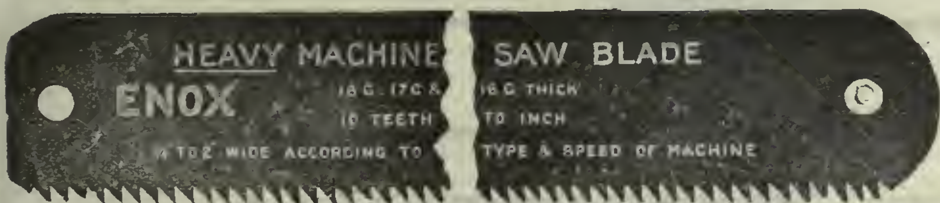


Instead of only one, it is equipped with two cutting-off tools—one cutting up and the other down. In this way they hold the work against each other and finish a job in just half the time, or do twice the work.

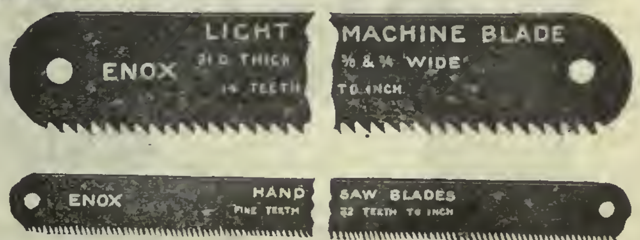
The details of this cost cutter will interest you. Write.

Hurlbut, Rogers Machinery Company
South Sudbury, Mass., U.S.A.

FOREIGN AGENTS—England, Chas. Churchill & Co., Ltd., London, Manchester, Glasgow, Newcastle-on-Tyne. H. W. Petrie, Toronto, Canada.



ENOX
Hacksaw Blades
ARE THE BEST



AGENTS IN CANADIAN TOWNS WANTED

Liberal Terms offered to firms willing to carry stocks and act as sole agents for the district.

Sole Makers:

FRY'S (LONDON) LIMITED

AN ENTIRELY BRITISH COMPANY

46 Upper Thames Street, London, E.C. 4, England. Works: Greenwich, S.E. 10

THIS sixty-four page advertisement has been prepared especially for buyers of manufacturing plant equipment.

To you, as such, it is an indication of our faith in the future and our desire to help you secure exactly that material so necessary to efficient and economical production.

Your problems of power, transmission, machinery, supply and transport——we will help solve them if you will put them up to our staff of specialists.

We ask your particular attention to the pages of this advertisement. Our 1,000 page general catalogue will be sent on request.

The Canadian Fairbanks-Morse Co., Limited

"Canada's Departmental House for Mechanical Goods"

Sales Offices in Every Large Canadian City

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Load---Unload---Convey---or Stack---at ½ Your Present Cost

Four things explain why the Brown Portable Handling Machines can save you from 50 to

75 per cent. over your present cost of handling your boxed, packed or rolled materials—because these machines are "built to fit the job," to fit every peculiarity of your handling conditions, because their carrying motion is continuous and because they are portable and sectional. You roll these machines to wherever the job is. If conveying, and you have a long stretch, you add so many sections. If a shorter stretch, you take out so many sections. Every machine carries its power with it—either electric, gasoline or kerosene.

Portable Continuous Motion Elevators — used to stack or elevate, or to load trucks, or used as a portable floor-to-floor Elevator;

Portable Continuous Motion Sectional Conveyors to eliminate all truckers and trucking between loading and delivery points; Portable Continuous Motion Loaders-Unloaders to load or unload cars, boats, according to design. Each machine may be used as an independent unit or as one of a series when any two or three handling operations may be performed as *one continuous* motion handling movement. Motion reversible. Made to handle barrels, boxes, kegs, drums, rolls, bags, coils, etc.—any package. Used in warehouses, mills, industrial plants, by steamship and railroad companies, by municipalities, by the United States, the British, French, and the Russian Governments — in use in 35 different countries because they save money and time.

Send complete details for suggestions on most economical handling methods, asking for Bulletin No. 141.

Brown Portable Conveying Machinery Co.
10 SOUTH LASALLE ST.,
Chicago, U.S.A.

Originators of Portable and Sectional Continuous Motion Machines for the low cost handling of packed material, and *only* manufacturing engineers devoted entirely to this line.

Canadian Representatives:

The Canadian Fairbanks-Morse Co., Limited

St John, Montreal, Ottawa, Toronto, Hamilton, Quebec, Calgary, Saskatoon, Vancouver, Windsor, Winnipeg, Victoria.


Rubber
Steel
VOORHEES RUB-STEEL VALVES
A CHEMICAL COMBINATION THAT IS PERFECT AND PERMANENT UNDER EVERY KNOWN PUMPING CONDITION.
Giving flexible seating against slippage—rigid support against highest pressure. Reversible surfaces constantly true.
MADE IN ONLY FOUR GRADES:
"RED CONDENSER" "SPECIAL SOFT" "SUPERHOT" "STANDARD"
Distributed from stock solely by
THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
Rub-Steel
"The Valve with a Backbone"

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

DURABLA

DURABLA

TRADE MARK REGISTERED

Sold on a Service Basis

DURABLA COMPRESSED ASBESTOS FIBRE SHEET PACKING is guaranteed to meet every flange condition in your plant, making a permanently tight joint wherever a gasket is required.

One Standard Material for all Gasket Work

Sole Canadian Distributors

The Canadian Fairbanks-Morse Company, Limited

Sales Offices in Every Large Canadian City

Manufactured by

Durabla Manufacturing Co., New York

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Canadian Representatives

of

Foster Engineering Co., Newark, N.J.

Manufacturers

of

Pressure Regulators — (Reducing Valves) for reducing pressures of steam, water, gas and air—General Service.

Relief Valves—For High and Low Pressure Boilers.

Pump Governors — For General Service Pumps.

Float Valves — (Water) for Open and Enclosed Tanks.

Float Valves — (Steam) for Open and Enclosed Tanks.

Float Valves — Bal'd Chron. for Sump Tanks, Bilge Pumps, etc.

Aut. Non-Return Valves —for Boiler Protection.

Emergency Stop Valves —for Boiler and Line Protection.

Back Pressure Valves— for Heating Systems.

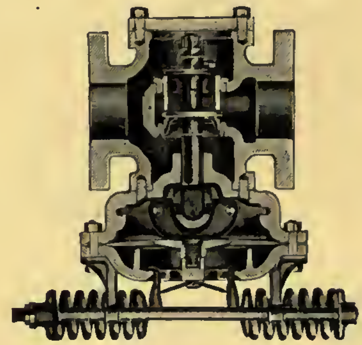
Free Exhaust or Relief —for Condensing Engines.

The Foster Float Valve

Auxiliary Operated

Angle Body Straight Body
Quick. Sensitive. Does not leak.

Wherever water or other liquid is used and the tank is of large capacity, or is located at a high point, it becomes an economical necessity to hold this level with a minimum of waste. The Foster Float Valve is the most satisfactory device on the market for this work.



Class "W"

The Foster Pressure Regulator

Over 75,000 in Use

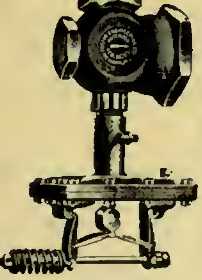
FEATURES

A compensating spring movement, exerting an unvarying pressure on the diaphragm.
Renewable seat rings.
Drop forge stem, levers, toggle levers (case hardened) insuring durability.
Great simplicity of construction and operation.
Small movement of diaphragm, insuring long life.
Ample steam capacity.
No friction of parts.
No small parts to clog.
No dash pot.
Noiseless in operation.
Absolutely automatic after adjustment as to pressure.
Every regulator carefully tested before leaving factory.
These regulators may also be applied on service other than steam. The manufacturers will advise if desired.

The Foster Class "G" Pressure Regulator

A superior, high grade pressure regulator that positively regulates.
Does not leak. Does not stick. Never fails.
Designed for severe and exacting service requiring close regulations, particularly for intermittent work. Suitable for working pressures up to 250 pounds. Main adjusting spring and single diaphragm obtain practically unlimited range of pressure on the terminal side from zero to within a small percentage of the initial pressure. Also particularly adapted for air service where valve is required to shut off and hold tight. It will operate equally well on horizontal or vertical type, either upright, inverted or inclined at any angle.

Foster Class "Q" Pressure Regulator



For steam heating or other service where the delivery pressure does not exceed fifteen pounds.

It is not intended to take the place of our class "W," but to meet the demand for a somewhat lower-priced valve, in service where it will do the work as well as a more expensively constructed one. It includes some of the best features of the class "W"—among others the toggle device to compensate for the variable spring power.

Write CANADIAN FAIRBANKS-MORSE COMPANY for descriptive circulars and full particulars of any line in which you are interested.

The Foster Class "G" Pump Governor

FOR STEAM PUMPS OR AIR COMPRESSORS

It will, beyond question, give better results in active service than any other governor for the purpose known.

We recommend it for hard service where the most service and acting duty and close regulation is required. Auxiliary operated—gives full area through the valve with one pound (1 lb.) or less reduction may be applied at any point at any angle on the pipe line—a desirable feature where headroom is limited.

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

In these days of gigantic demand Nortons everywhere keep production up

Here's a grinding job up in Vermont at the Jones & Lamson plant. It's a Drum Drive Shaft for a J & L Turret Machine. The material is machine steel and its rough size is 1 9/32-in. x 1 17/32-in. x 1 25/32 in. x 1 13/32 in. The finished size is 1¼ in. x 1½ in. x 1¾ in. x 1⅜ in.

A limit is set of .0005 in.—and maintained at the rate of 28 complete shafts per day.

Isn't an installation—in a plant so thoroughly well known in the quality field as Jones & Lamson—an endorsement for Nortons that you can't afford to overlook when you are ready for grinding machines?

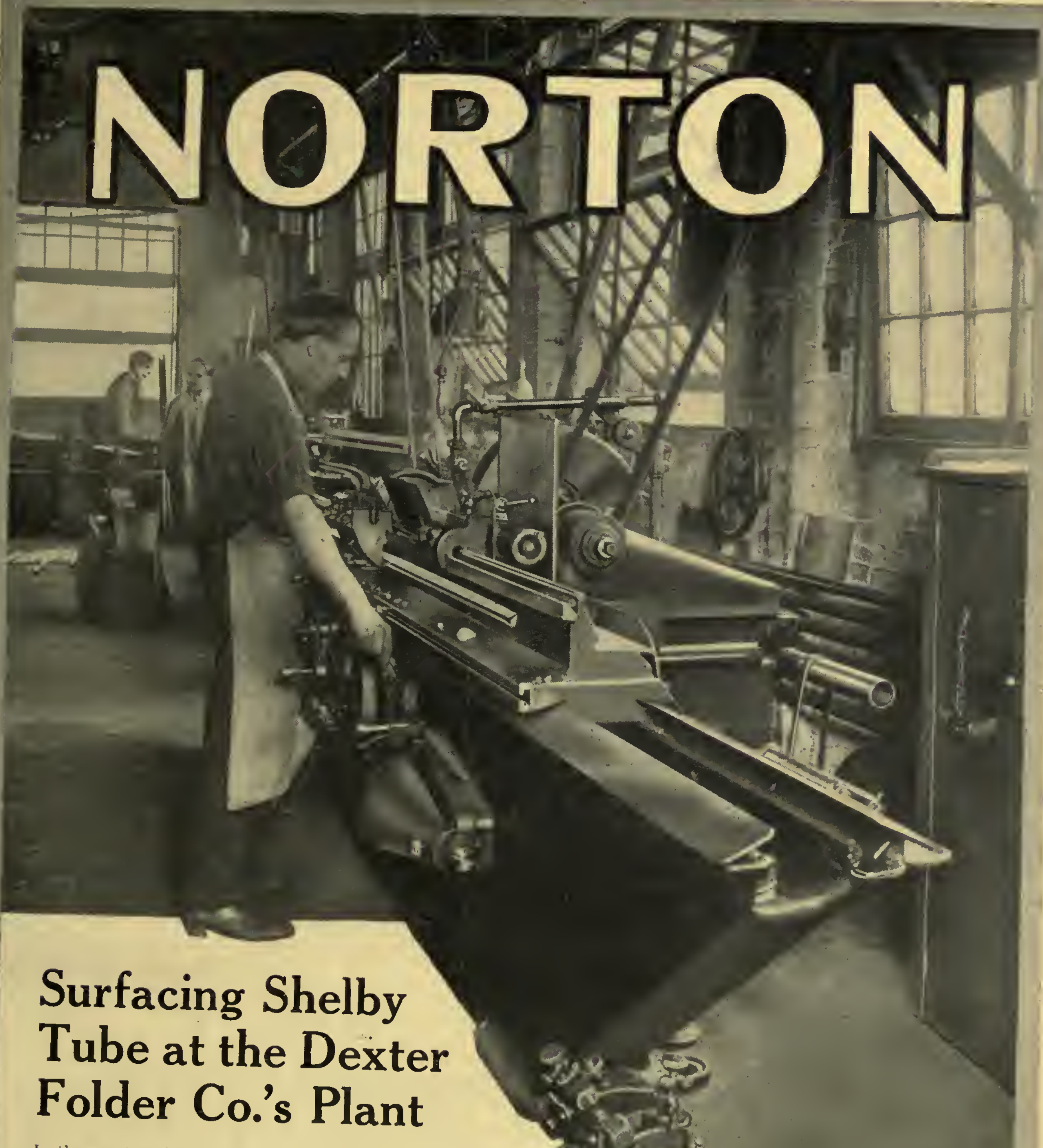
Norton Grinding Company, Worcester, Mass.

Chicago Store: 11 North Jefferson Street

Canadian Agents:

The Canadian Fairbanks-Morse Company, Limited

St. John Quebec Montreal Ottawa Toronto Hamilton
Windsor Winnipeg Saskatoon Calgary Vancouver Victoria


NORTON


NORTON
NORTON GRINDING WHEELS
Alundum

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Clover Grinding Compound

Many manufacturers found Clover Grinding Compound a blessing during war production.

It saved many hours' time, and did a better job wherever it was used. Among other work, it was used for

Lapping Crank Shafts	**Grinding Pistons into Cylinders**
Surfacing	**Grinding Cylinder Heads in place**
Grinding Valves	**Running Gears together, etc.**

Made in seven grades.

1A - A - B - C - D - E and No. 50. Put up in 1 lb. and 25 lb. cans.

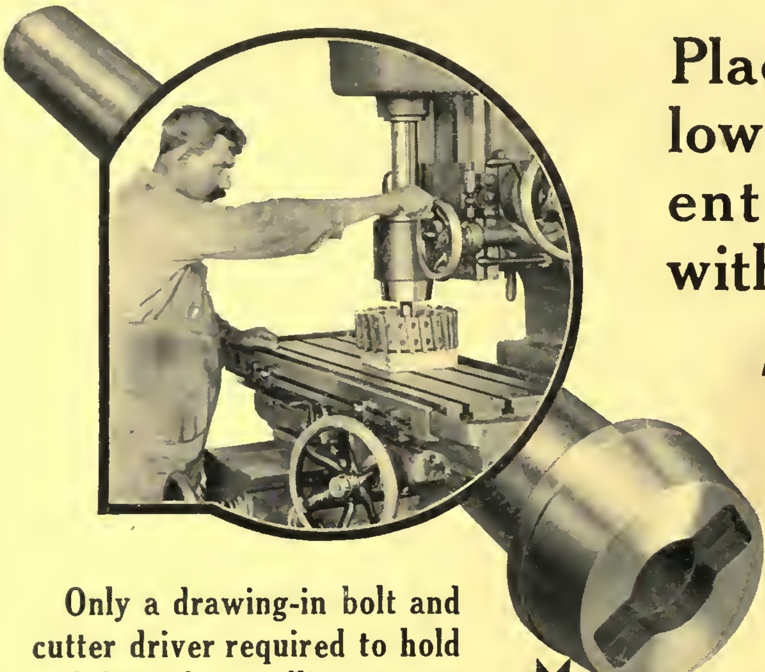
Clover Manufacturing Company

NORWALK, CONN.

Canadian Distributors

The Canadian Fairbanks-Morse Company, Limited

Offices in Every Large Canadian City



Place cutter on table, lower spindle until nose enters cutter, fasten with drawing-in bolt—

Simple, isn't it?

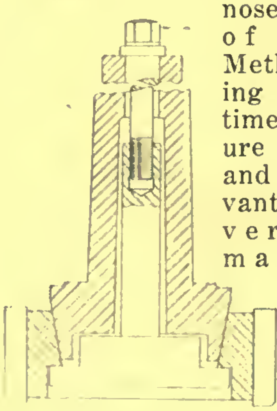
And it is just as simple as it sounds to put a face milling cutter of any size on

Brown & Sharpe Vertical Spindle Milling Machines

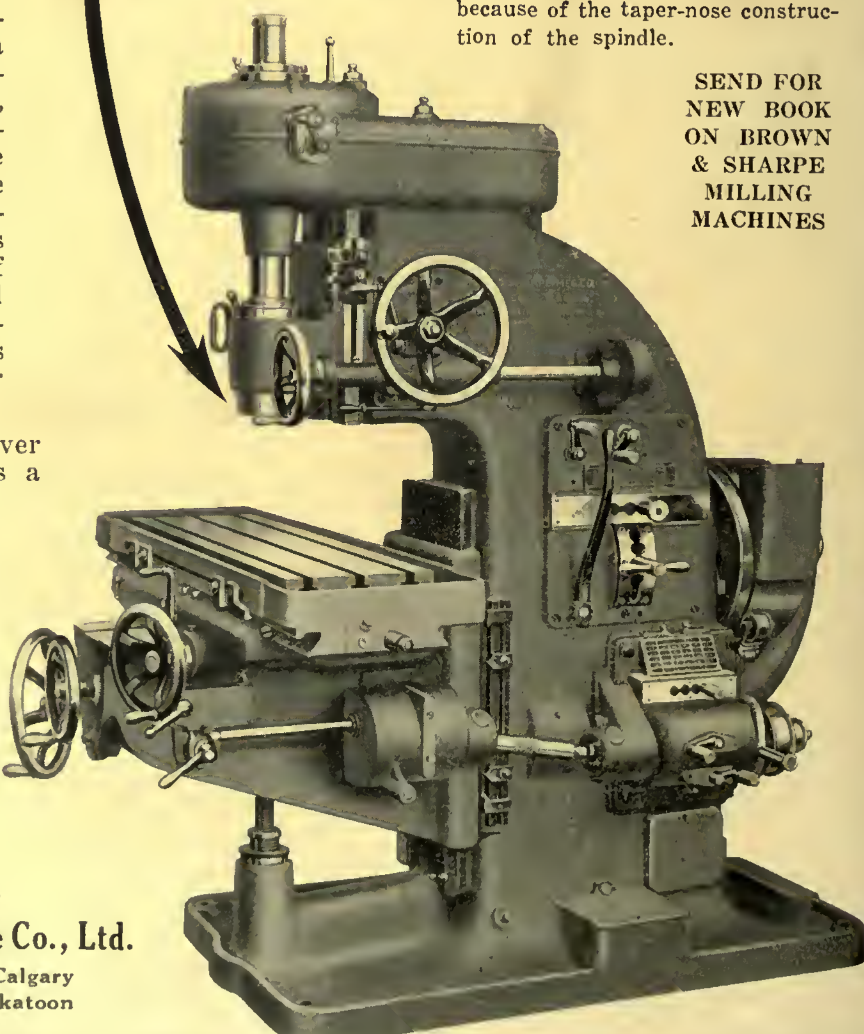
because of the taper-nose construction of the spindle.

SEND FOR NEW BOOK ON BROWN & SHARPE MILLING MACHINES

Only a drawing-in bolt and cutter driver required to hold and drive face milling cutters on Brown & Sharpe Milling Machines because of the taper-nose construction of the spindle. Method of attaching cutter is a time-saving feature on all types, and especially advantageous on the vertical spindle machines. Diagram shows method of holding and driving cutter by means of cutter driver and drawing-in bolt.



When in place the cutter driver serves as a clutch and assures a positive drive.



Let us tell you in detail of this and the many other features of

Brown & Sharpe Milling Machines.

Send for Literature.

Brown & Sharpe Mfg. Co.

Providence, R.I., U.S.A.

Canadian Representatives:

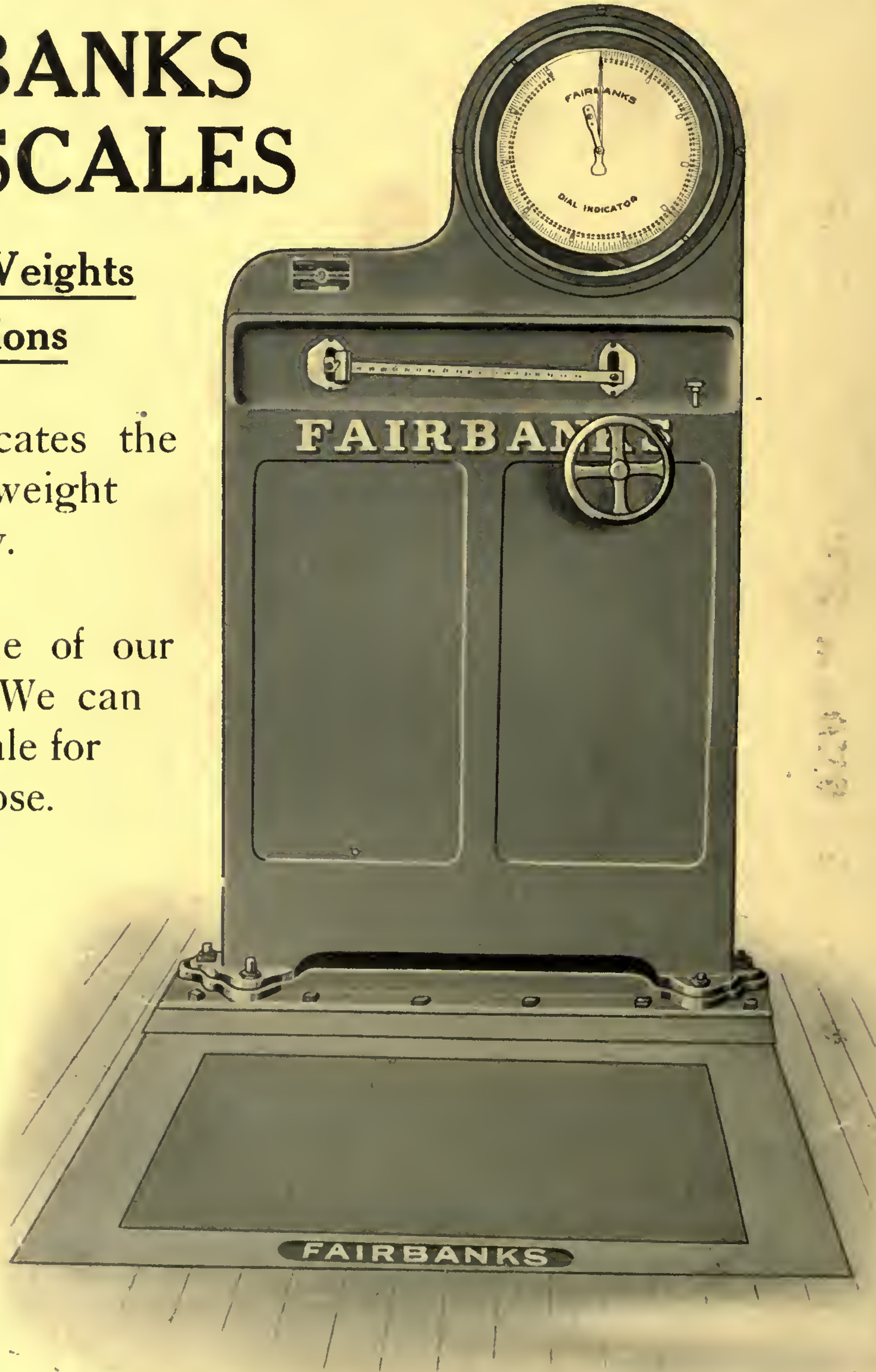
The Canadian Fairbanks-Morse Co., Ltd.

Toronto Montreal Winnipeg Calgary
Vancouver St. John Saskatoon


Isn't This a Beauty?
More Shells!
A Vivid Patriotic Poster in Six Colors Sent free on request
The Message from France
THE CLEVELAND TWIST DRILL CO.
The 1919 Calendar of
The
CLEVELAND
TWIST DRILL COMPA
CLEVELAND, O.

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

FAIRBANKS DIAL SCALES



No Loose Weights
No Calculations

The Dial indicates the gross or net weight directly.

This is but one of our many types. We can furnish a scale for any purpose.

WRITE FOR FULL PARTICULARS

The Canadian Fairbanks-Morse Co., Limited

"Canada's Departmental House for Mechanical Goods."

DEPARTMENTS

Scale, Valve, Auto Accessory, Engine, Pump, Electrical, Transmission, Railway and Contractors, Machine Shop Supply, Marvel Mill, Pulp and Paper.

SALES OFFICES

Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria.

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Sleeve Bar with Holder.


Plain Bar

Williams' "Agrippa" Boring Tool Holders for Multiple Bars

RAISE NO BAR AGAINST THE SELECTION OF BARS
THE CHOICE IS YOURS

THE same holder can be used for all sizes of Boring-Bars which come within the range of either of the V grooves at top and bottom of the reversible Cap with the "twin-screw" fastening; no bushings or shims are necessary.

For instance, the smallest Holder, No. 080, accommodates Bars from 3/16 to 1/2" diameter, while the largest, No. 83, holds Bars from ½ to 1⅛" diameter. Three intermediate sizes of Holders are also in stock.

We furnish two types of Standard Bars as illustrated—they are interchangeable in the Holder.

In the *Sleeve-Bar*, the Cap admits a straight or angular Cutter; either can be quickly inserted at the business end of the Bar without removing the Cap or disturbing the setting of either the Bar or the Holder.

The *Plain-Bar* provides for the use of both styles of Cutters in the simplest manner possible and is furnished with Headless Screws.

Williams' "Agrippa" Tool Holders, *"The Holders that Hold" for*

BORING	PLANING	THREADING
TURNING	CUTTING-OFF	KNURLING
	SIDE WORK	

Booklet describing *Superior* Machinists' Tools on request

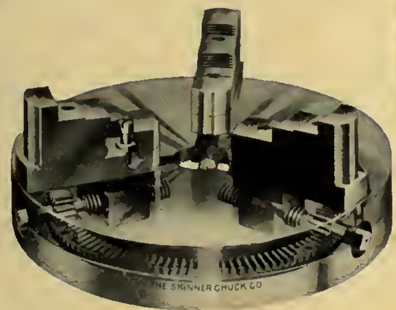
J. H. Williams & Co.

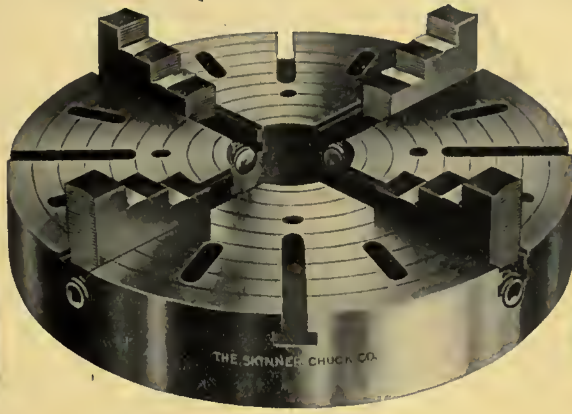
"The Drop-Forging People"

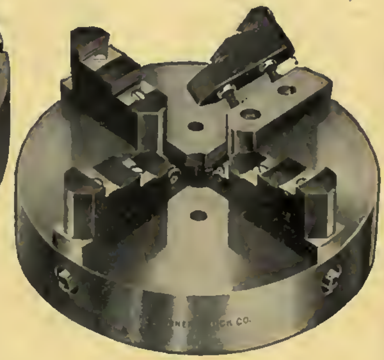
Western Office and Warehouse:
45 So. Clinton St.
Chicago, Ill.

General Offices:
45 Richards St.
Brooklyn,
N.Y.

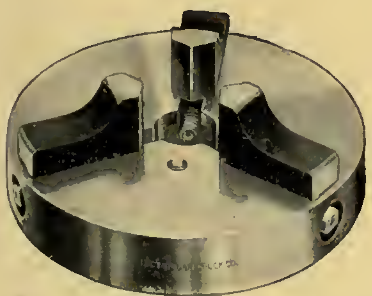
For Sale by The Canadian Fairbanks-Morse Co., Limited





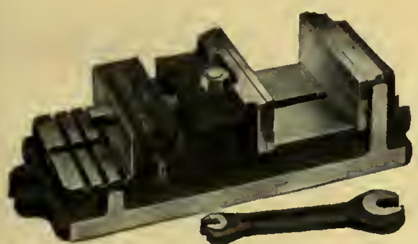


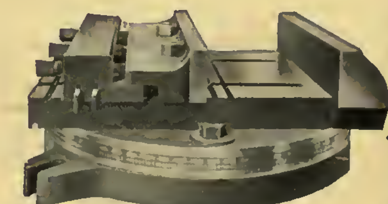
SKINNER CHUCKS



For
**Lathes, Drill Presses,
Milling Machines,
Planers**

A Complete line of
Chucks for all
chucking
operations

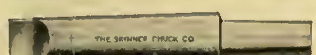




THE SKINNER CHUCK COMPANY

Main Office and Factory
New Britain, Conn., U.S.A.

Far Sale by The Canadian Fairbanks-Morse Co., Limited



CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

"An Instant Fit"

Nicholson
EXPANDING MANDRELS

With Nicholson Expanding Mandrels there is no hunting through a pile of solid mandrels for a mandrel to suit the size of work.

One set of nine Nicholson Expanding Mandrels are all that's needed to fit any size square or round hole between one to seven inches.

They center immediately—and can be collapsed and knocked out in a few seconds.

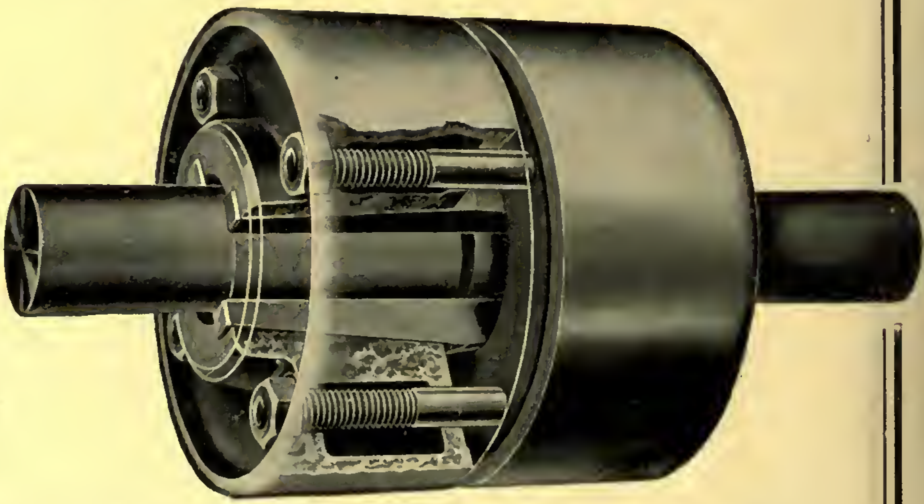
Make Every Move Count

Your machines will be producing every minute. Increased production simply has to follow, with greater accuracy.

"Nicholson" cannot distort. The jaws are always concentric.

Write us to-day for full details, or we will loan you one for thirty days. After that it is up to you.

Nicholson
PATENT
Compression SHAFT COUPLING



Severe working and dynamometer tests have proven that the Nicholson Coupling possesses the most powerful grip of any coupling on the market.

It is the only compression coupling known that will withstand a strain on a 5-inch shaft, that is sufficient to twist off the shaft itself, as the "Nicholson" has been known to do and in many cases on shafts less than 5 inches.

The reason why the "Nicholson" will twist off a shaft where its competitors will slip, is because it possesses a powerful **four-sided grip** (similar to that of a lathe chuck), obtained by drawing together the tapering bore castings over four double tapering steel jaws, secured by an ample number of through bolts; a grip that is unquestionably the most powerful that is obtainable.

The grip of the "Nicholson" differs from the other makes of couplings, most of which are constructed with a case split bushing—which compresses eccentric fashion, and does not conform to the shaft. In this style coupling there is a lot of power expended in overcoming the friction between the outside of the bushing and the bore of the flange castings.

The Nicholson coupling draws tight much easier than any other; as the friction is largely eliminated, and the four steel jaws make a perfect fit and grip.

OVER 50,000 NICHOLSON PATENT SHAFT COUPLINGS NOW RUNNING.

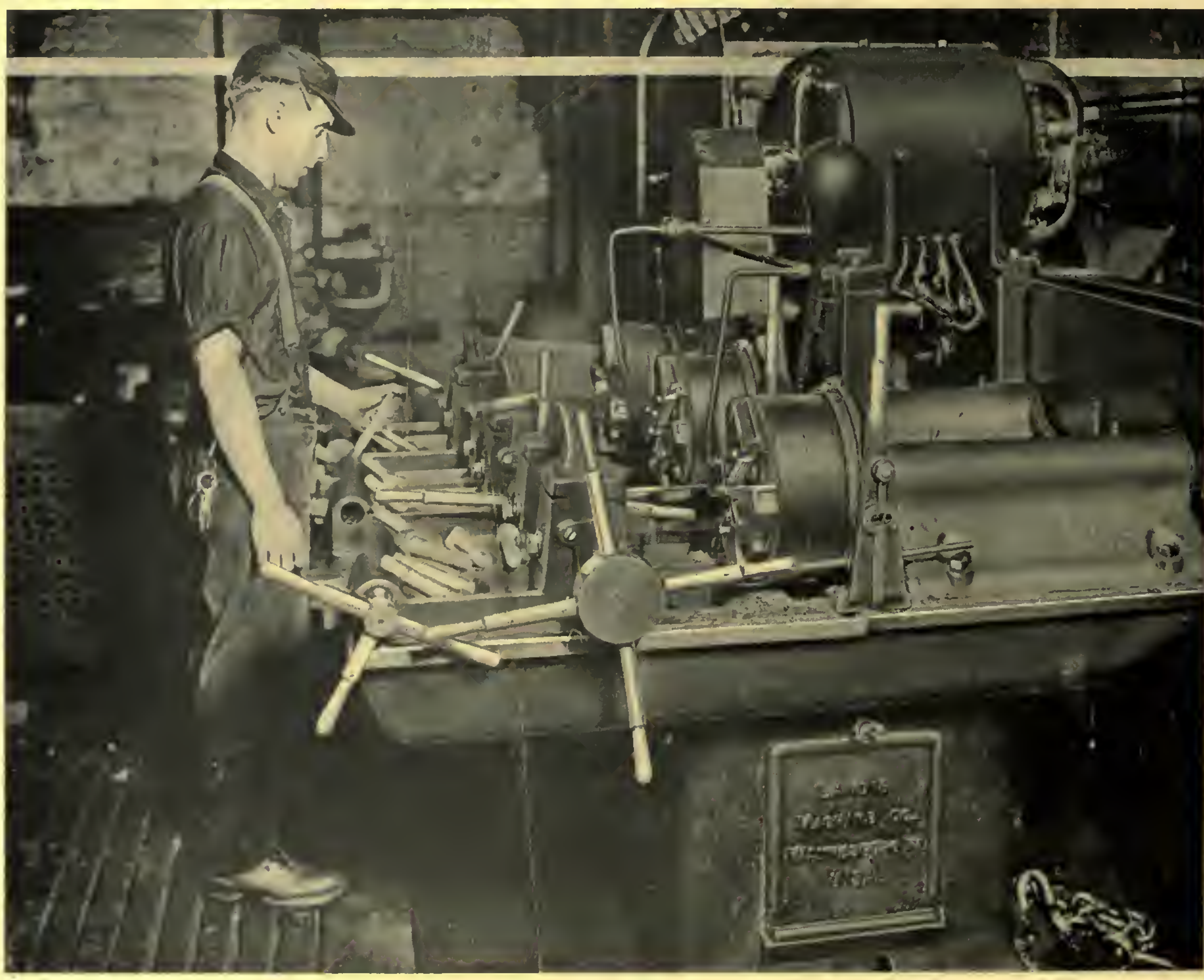
Drop us a line for full particulars.

W. H. Nicholson & Company., 114 Oregon St., Wilkes-Barre, Pa.

For Sale by The Canadian Fairbanks-Morse Co., Limited

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

"No Trouble Since We Got This Threader"



Said the operator of this 2" Landis Triple Head Threading Machine, and he further opined that it could not be beaten for ease of operation and high production. This statement, made after eight years of service in a railroad shop, speaks for itself.

On an average, three thousand 1½" bolts are threaded every ten hours on this machine, but it is particularly advantageous for cutting long lengths of threads. The quality of threads is up to the Landis Standard, which means well-formed and accurate.

It was with a machine similar to this one that a test was made in a big railroad shop as to the economy of Landis Dies as compared with other types. It was found that when the Landis Die was used it cost $4.95 to thread 100,000 bolts, and with the other types of dies the cost was $48.39. Needless to say the Landis Die, by cutting costs to almost one-tenth was adopted throughout the plant.
How much does it cost to cut your threads? Submit your specifications and we will show you the Landis way.

Catalogues on request—
No. 24—Bolt Threading Machines.
No. 23—Pipe Threading Machines.

Canadian Agents — Ontario: Canadian Fairbanks-Morse Co., Ltd., Toronto; Quebec: Williams & Wilson, Ltd., Montreal.

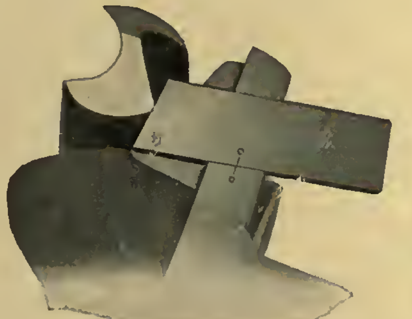
Landis Machine Company

Waynesboro, Pa.

For Sale by The Canadian Fairbanks-Morse Co., Limited

CANADIAN
FAIRBANKS MORSE
EVERYTHING MECHANICAL

2 LIP DRILLS — 3 LIP DRILLS — 4 LIP DRILLS



Can be correctly sharpened on WORCESTER DRILL GRINDERS without any adjustment to the Lip Rest.

MADE FOR ALL SIZES FROM No. 60 TO 4".

THE WASHBURN SHOPS
OF THE
WORCESTER POLYTECHNIC INSTITUTE
Worcester, Mass., U.S.A.

For Sale by The Canadian Fairbanks-Morse Co., Limited

HALL

Pipe Threading Machinery

Illustration shows the new No. 8 Hall Gear Box Driven Pipe Lathe. Regular capacity 2½" to 8" inclusive.

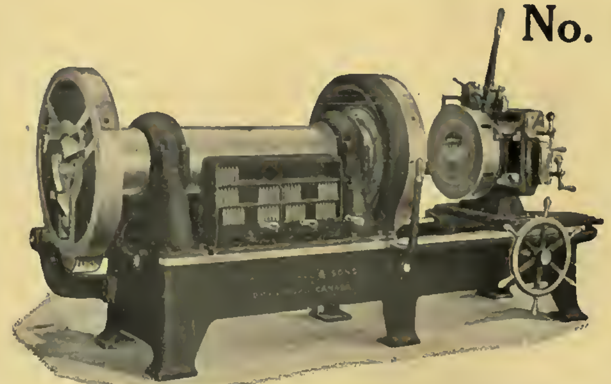
The last word in Pipe Machine Construction.

Let us give you full particulars of this machine which is only one of a large number having capacity ⅛" to 18" pipe. Write us for catalog and prices on:

PIPE THREADING MACHINES
NIPPLE THREADING MACHINES
ROLLER PIPE CUTTERS, or
CUTTING-OFF MACHINES.
Any capacity ⅛" to 18".

MADE IN CANADA

No. 8



John H. Hall & Sons, Limited
Brantford, Canada

For Sale by The Canadian Fairbanks-Morse Co., Limited

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

WALCOTT SHAPERS

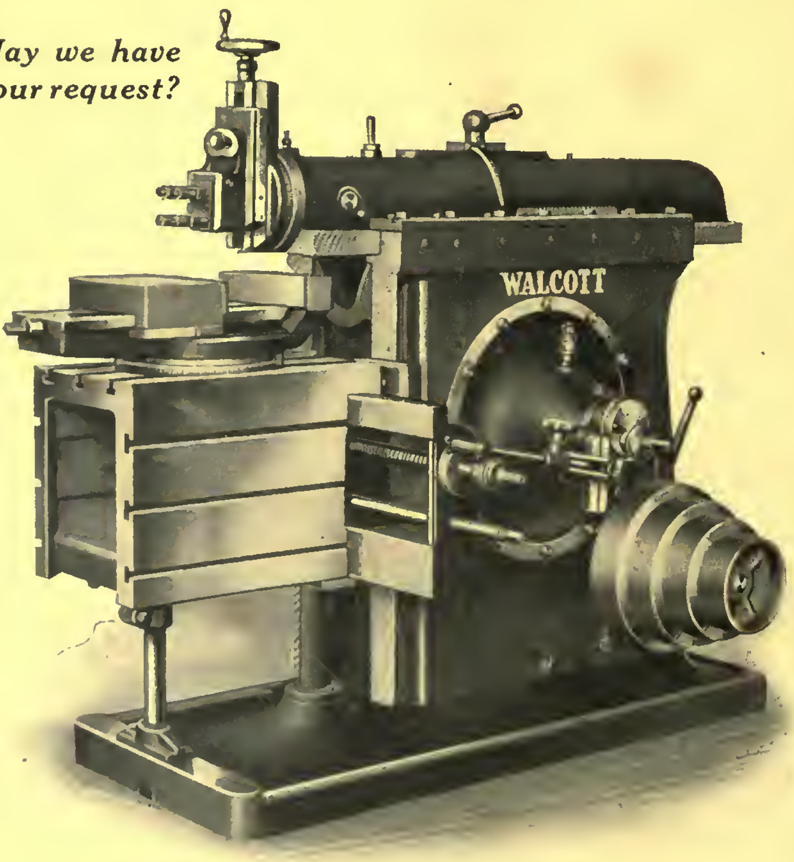
Built to Endure—

Walcott Shapers are built to endure the hardships imposed upon shop equipment during the war-time pressure of heavy production. Prominent features in this connection are the general heavy construction where strains are most likely to occur, extra large bearings throughout to compensate for wear, and perfect lubrication.

The bull gear pinion is made of high carbon steel, and runs loose on the ground shaft of high carbon steel. Bronze bushings are provided in this pinion, and the same is oiled by a large oil chamber through the centre of the shaft.

All gears are of coarse pitch and wide face and helical design, thus insuring a quiet, smooth running machine with absence of any chatter. This permits a greater number of cutting strokes, thereby increasing the output of the machine.

May we have your request?



The above are but a few of the good features that are responsible for the great endurance qualities of the Walcott Shaper. We have not touched on the features of simplicity, ease of operation, high speed features, etc., but we would like to send you bulletins giving all the details of our shapers.

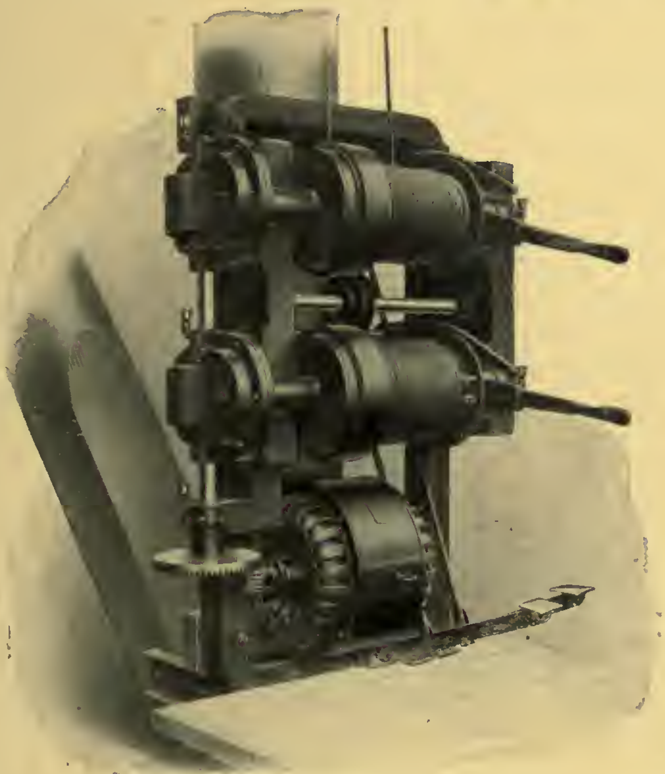
JACKSON SHAPER COMPANY

JACKSON, MICHIGAN

Canadian Sales Agents

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

ELECTRIC HOISTS



This is a new design of hoist made in two sizes with capacities of 1,000 lbs. and 2,000 lbs. on a single line. These machines are designed with high speeds for fast work on light loads. Loads of 5 tons on the smaller and 10 tons on the larger can be handled with proper arrangement of hoisting lines.

This machine is self-contained, main reduction is through steel worm and bronze worm wheel running encased in grease. Load is picked up by large cone frictions, lowered by hand break, and held automatically by forged steel dog. Constant speed standard motors used. Machine arranged for vertical or horizontal position as required.

Single I-Beam and Double I-Beam Cranes

Capacities 1 to 10 tons, spans 15 to 40 ft. Truck wheels have chilled treads, roller bearings. Trolley wheels have turned treads, roller bearings. Clearance required 4" from center of rail to outside, minimum head clearance.

JIB CRANES. Electric Jib Cranes 2 to 5 tons capacity. We have designed and manufactured two of the largest electric jib cranes in use, 5 tons capacity, 60 ft. boom, 60 ft. mast. High speeds, 60 ft. hoist, 250 ft. trolley travel, ¾ turn in 15 seconds.

DERRICKS. Large steel derricks, both stiff leg and guy type. Capacities from 10 to 50 tons. Derrick irons for wooden derricks, 10 to 25 tons capacity.

Pollard Manufacturing Co., Limited

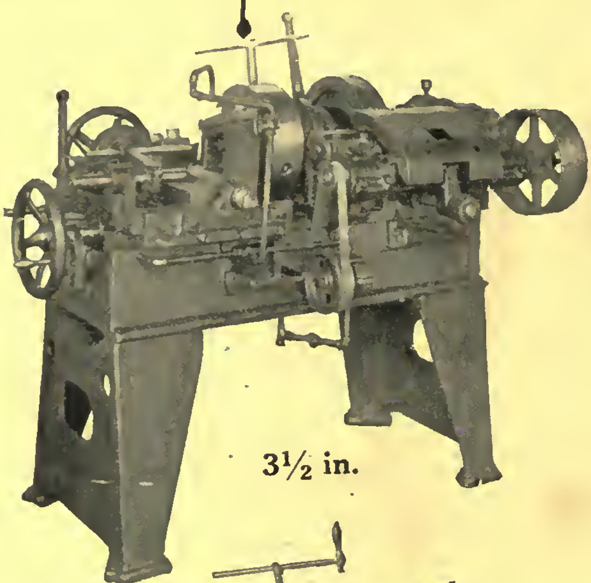
Niagara Falls, Ontario

Canadian Sales Agents
The Canadian Fairbanks-Morse Co., Limited

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

THE JOHNSON FRICTION CLUTCH

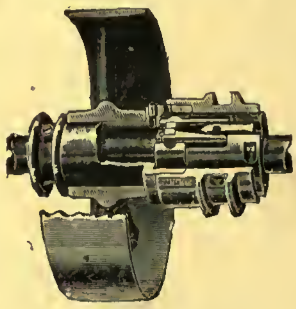
Here



3½ in.

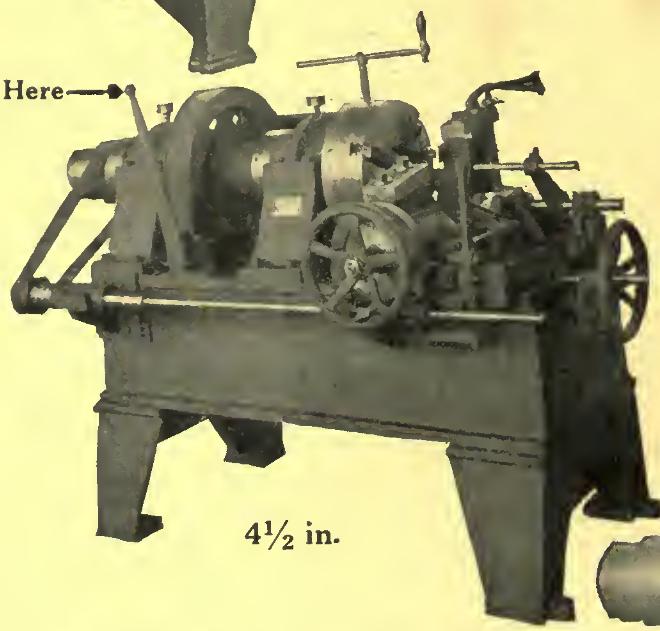
One large user is the Williams Tool Co., Erie, Pa., who have adopted the Johnson Friction Clutch for their heavy cutting-off machines illustrated the capacity of which ranges from 3½ to 5 inches of heavy bar steel.

The clutches are located in the head-stock, as indicated by the arrows, being operated by the simple lever action characteristic of all Johnson Friction Clutches. The clutch is incorporated between two spur gears and controls starting, stopping, and change of feed.



Single Clutch Pulley Mounted—Clutch engaged.

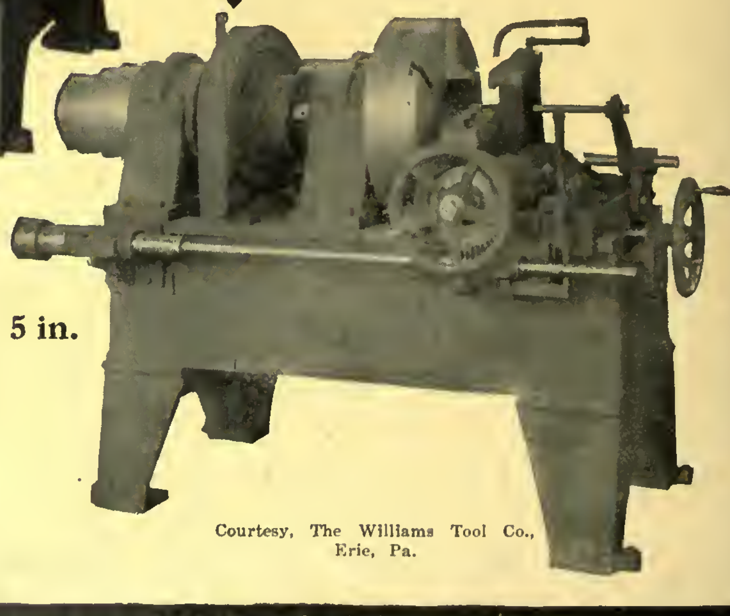
Here



4½ in.

The value of the Johnson Friction Clutch is finding increased recognition wherever the consideration of Quality is allowed to rule. What are your requirements? Remember, we will specify a Johnson Friction Clutch for your requirements at no expense or obligation to you.

Here



5 in.

Courtesy, The Williams Tool Co., Erie, Pa.

You should have our Booklet, "Clutches As Applied in Machine Building" and Yellow Data Sheets. Write right now.

AGENTS:

Canada: The Canadian Fairbanks-Morse Co., Ltd., Montreal, and branches.
Williams & Wilson, 320 St. James St., Montreal, and branches.

England: The Efandem Co., 22 Newman St., Oxford St., London, W. 1, Sole Agents for British Isles.

Australia: Edwin Wood Pty., Hardware Chambers, 231 Elizabeth St., Melbourne, Victoria.

Japan: Andrews & George Co., 16 Takegawa-cho, Kiobashiku, Tokyo.

South Africa: D. Drury & Co., Main St., Johannesburg.

France: Anciens Etab. Glaenzer & Perreaud, 18 Fauborg du Temple, Paris.

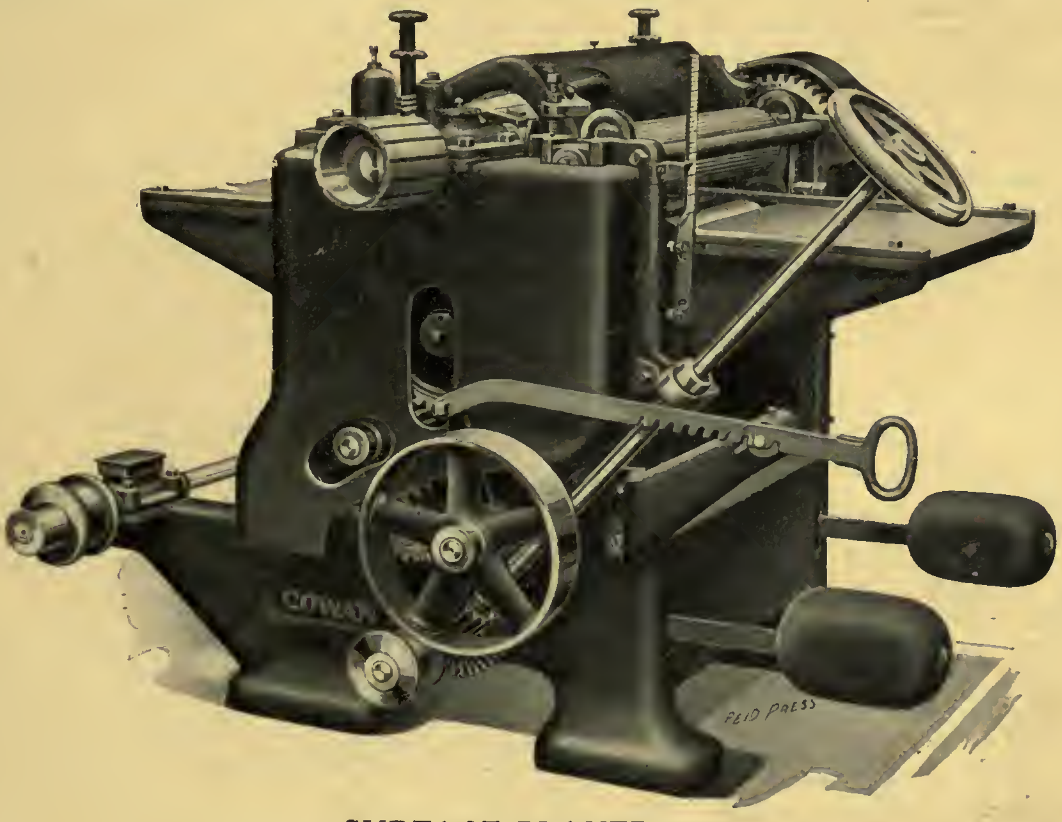
THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Cowan Woodworking Machinery

FOR

Pattern and Carpenter Shops; Planing Mills; Sash, Door and Furniture Factories; Shipbuilding Plants; Carriage and Wagon Shops, etc., etc.



SURFACE PLANER 141

A Substantial Medium Weight Machine.
Capacity 20″, 24″ or 26″ wide x 8″ thick

A Favorite Pattern, Carpenter and General Wood Shop Machine.

—We Make—

PLANERS	MORTISERS	BAND SAWS	SANDERS
MOULDERS	BORERS	SCROLL SAWS	GRINDERS
SHAPERS	LATHES	CROSS CUT SAWS	CLAMPS
TENONERS	RESAWS	RIP SAWS	VENEER PRESSES

Cowan & Company of Galt Limited

Galt, Ontario

For Sale by The Canadian Fairbanks-Morse Co., Limited

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

A Better Belting

—because it is better built

OUR own practical experience with Goodyear Extra Power is one of the best reasons we have for recommending its use to you.

We have used this modern type of belting in our own plant—used it largely, on all kinds of drives.

We have found it a better belt—a belt that yields splendid service — long and trouble-free service — under the most difficult conditions.

That's because it is scientifically constructed to ensure those features you expect from a belt—lasting service, economy, flexibility, freedom from trouble.

Its construction guarantees great strength and balance, without power-squandering weight.

"Extra Power" is flexible—it is long-lasting.

Add to its natural flexibility its gripping surface and you have a belt that hugs the pulleys for the last ounce of power.

No obligation is involved in getting the trained and expert advice of our belting men.

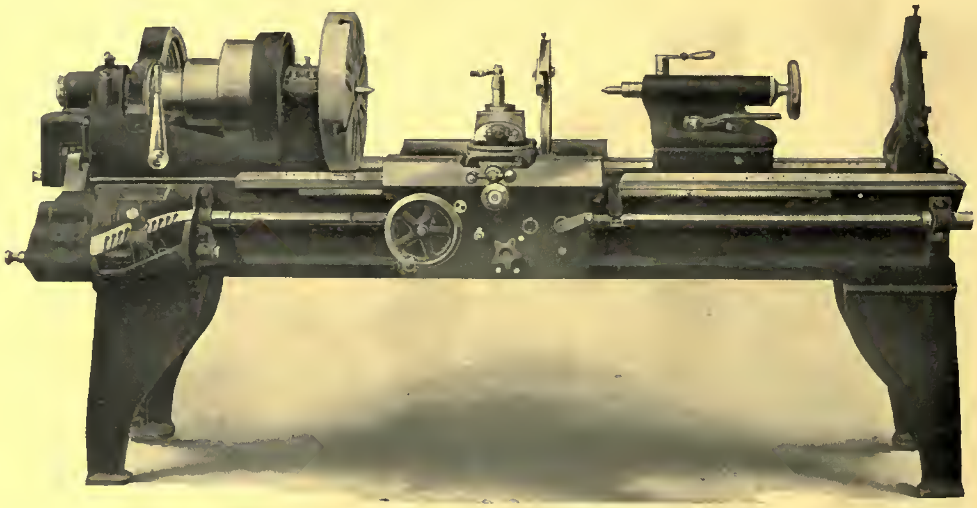
The Canadian Fairbanks-Morse Company, Limited

St. John Quebec Montreal Ottawa Toronto Hamilton
Windsor Calgary Vancouver Victoria
Winnipeg Saskatoon

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

THE PERFECT 18-INCH LATHE

"THE TOOL WITH THE APPETITE"



ALL THAT IT LOOKS TO BE

A machine tool capable of doing the toughest machining jobs, and of doing them economically; a machine tool capable of delivering the most accurate work at a high rate of speed; a machine tool of extreme regidity, of great power—such is

This Double Back-Geared, Quick Change Gear "Perfect" 18-inch Lathe

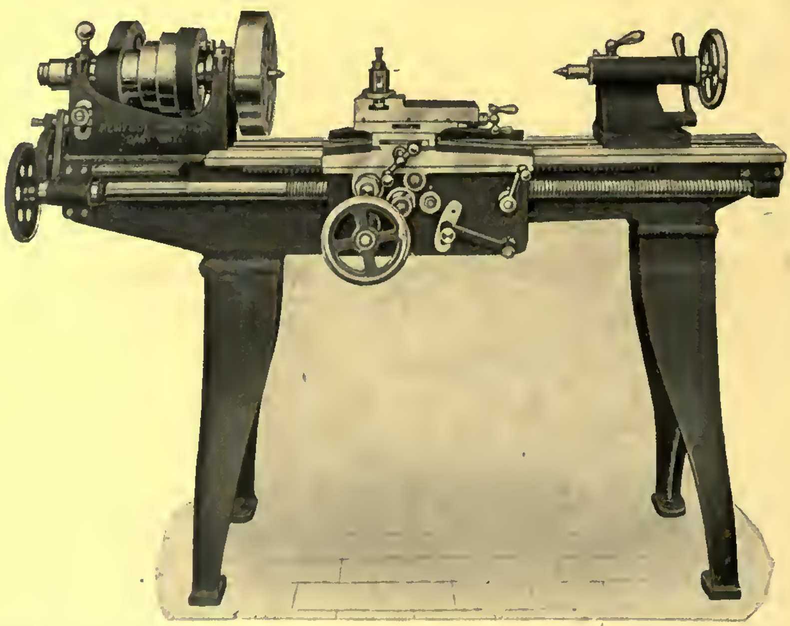
You will admire its ability to send production climbing hand in glove with perfect accuracy.
You will appreciate the exclusive features that so noticeably make for operating convenience.
You will be pleased you put it in your shop—and so willthe man that runs it.
Aask up to-day for Catalog fully describing this "Perfect" Lathe.

SCREW CUTTING ENGINE LATHE WITH GAP

Accurate. Convenient Design.

Small consumption of Power and Low Price.

A Lathe in a class by itself.



Just the Tool for Machine Shops, Experimental Shops, Technical Schools, Garages, Etc.

Built in 2 sizes, 12" and 14" swing, 6' and 8' Bed

Perfect Machine Co. - - Galt, Ont., Canada

For Sale by The Canadian Fairbanks-Morse Co., Limited

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

These Grinders have stood the test, they're rigid. The wick oiling device can't go wrong. They're built right, with the proper material, by expert workmen.

Guards or Exhaust Hoods furnished on request.

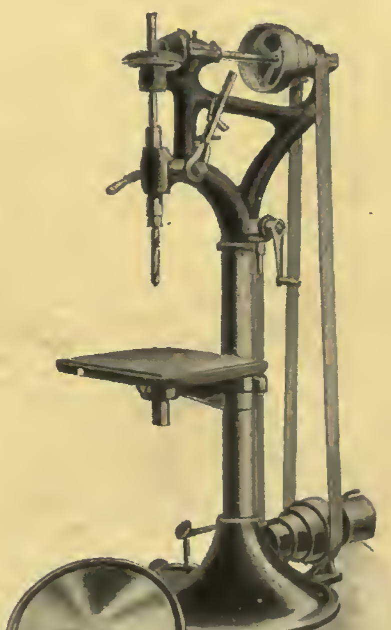
The Heads alone can be used for Bench Grinders. The ordinary tight and loose pulley C.S. furnished unless otherwise ordered.

No. 0 PERFECT HIGH SPEED HACK SAW

Capacity 0" to 5". Blades 10" to 14". Permanent or Swivel Vise. A real machine tool with the latest improvements. Worth investigating.

No. 14 PERFECT 14" DRILL

Driven by a 1¼" flat belt. Round or oblong table. Pedestal or bench type.



No. 19 PERFECT 20" DRILL

Geared 2 to 1. 2" flat belt. Plenty of power. Get the price and then compare them with other Drilling Machines.

Perfect Machine Co.

GALT, ONT., CANADA

For Sale by The Canadian Fairbanks-Morse Co., Limited

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FAIRBANKS-MORSE
EVERYTHING MECHANICAL

METALWOOD

Reg. U. S. Patent Office

Hydraulic Accumulator Systems Complete:

Pumps, Valves, Forged Steel High Pressure Fittings, Etc.

Metalwood Manufacturing Company

DETROIT, - U.S.A.

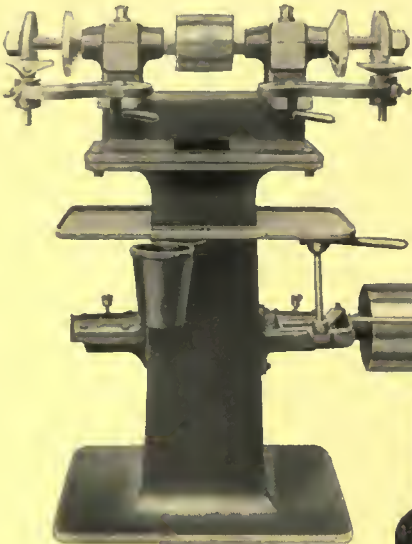
Canadian Fairbanks-Morse Co., Limited

Montreal and Toronto

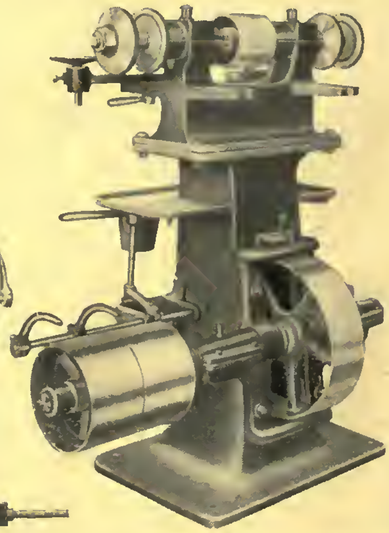
Exclusive Sales Representatives for Canada

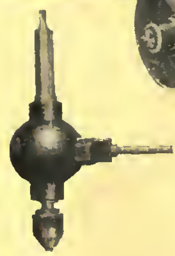
Self-Contained Countershaft Grinder

The most important advantage of these grinders is the very smooth running of the wheels. The belt strain being down against the body of the machine gives the wheels a smooth running motion, which is impossible to get with this class of machine belted up. Arbors are of 40% carbon steel, thread two pitch coarser than standard. Let us put all the advantages before you. Write for full particulars.



Front view.





Tapping Chucks—

Our Tapping Chucks are made in four sizes. All steel and bronze—and very durable.

Tapping Machines—

In two sizes vertical, one size horizontal. Foot actuated. Both hands free to handle work makes this machine very rapid.

These machines are carried in stock by some of the leading dealers in Canada, England, France, South Africa, New Zealand and Japan.
Send for our Catalogue. It has information worth having.

Saint Louis Machine Tool Co., St. Louis, U.S.A.
For Sale by The Canadian Fairbanks-Morse Co. Limited

American Power Plant Specialties

American Thompson Improved Indicator

Uniformly accurate satisfactory service is assured the user of these well-known Power Plant Instruments which have been on the market for sixty-five years. Tell us your needs.

AMERICAN STEAM GAUGE & VALVE MANUFACTURING COMPANY

BOSTON, MASS., U.S.A.

SOLE CANADIAN AGENTS

The Canadian Fairbanks-Morse Co., Limited

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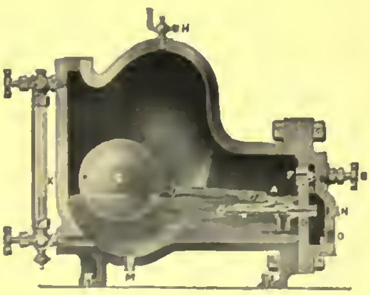
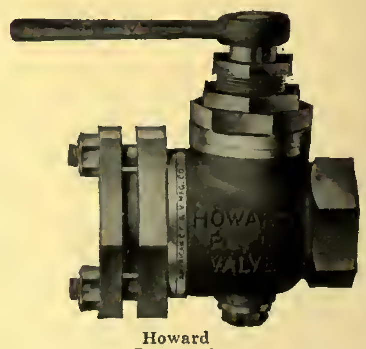
American Recording Gauge



American Ideal Steam Trap

Iron Pop Valve

Whistle



Howard Improved Ball Valve

CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

METLSKIN does prevent scale

Send for this illustrated booklet. It explains the dose, the method of action, and other important details

Some of Canada's and the United States' biggest and most representative plants have learned the truth of the above statement from first-hand experience.

So many "compounds" and "cure-alls" have been foisted upon unwary power-plant owners that the feeling, common to many of them, is one of doubt, of skepticism. And small wonder!

METLSKIN is not a "compound," nor does it work on the same principle. It is a boiler metal treatment, a boiler preservative that gradually removes scale by a safe process.

When the scale has been entirely removed METLSKIN forms a minute, grayish-white skin or covering over the bare metal.

So long as the daily dose is continued the scale-forming particles in the feed-water cannot adhere to the metal. Nor will METLSKIN work injury to any part of the boiler or system. That is one of the strongest features of the GUARANTEE BOND.

METLSKIN cannot contaminate the steam. It may be used safely in any plant where live steam comes in contact with the manufactured product.

If you are a skeptic, a doubter, ask for the booklet, GUARANTEE BOND, prices, etc. You will be interested, we know.

CANADIAN FAIRBANKS-MORSE COMPANY, LIMITED

ST. JOHN — QUEBEC — MONTREAL — OTTAWA — HAMILTON — TORONTO
WINDSOR — WINNIPEG — SASKATOON — CALGARY — VANCOUVER — VICTORIA

THE reduction of current and maintenance cost by Laco Nitro Lamps is due to two prime reasons: Their high candle power requires fewer lamps, and their long life reduces replacements. Official tests have proved that Laco Lamps burn 30% to 50% less current and last 25 to 50% longer than any other make.

Call our lighting experts into consultation to-day. They will help you devise the best system to meet your needs.

Our pamphlets and data are instructive and prove the value of good lighting.

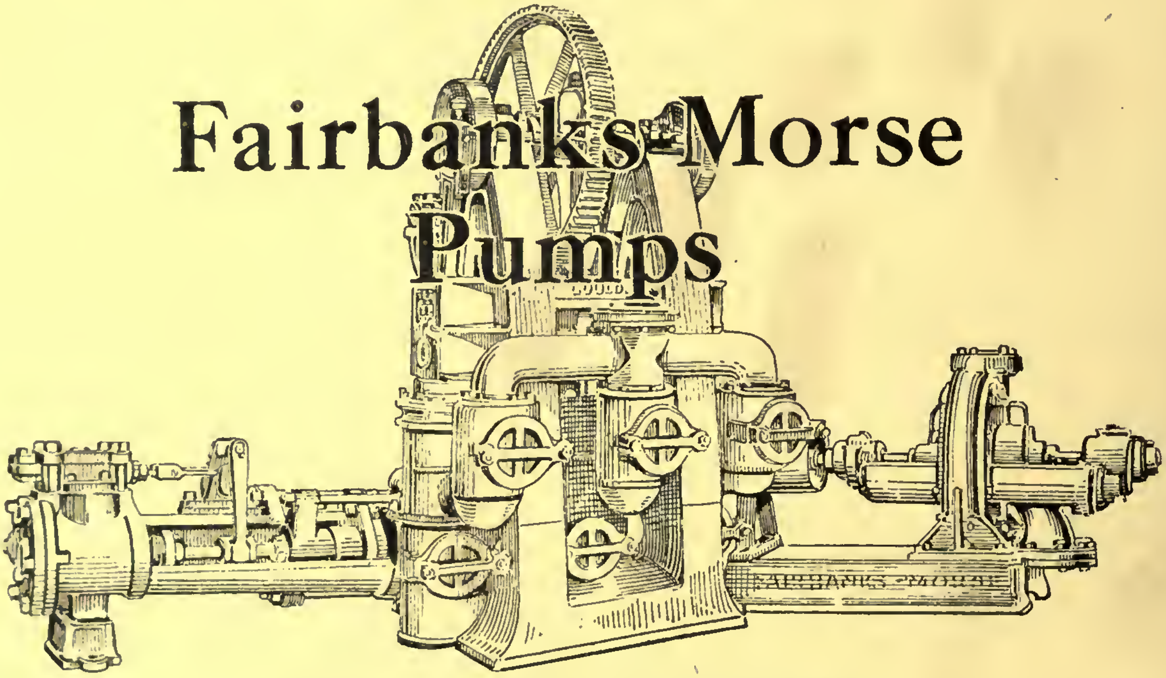
Canadian Laco-Philips Company, Limited

Montreal — Toronto — Winnipeg — Vancouver

LACO NITRO LAMPS

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Fairbanks-Morse Pumps



for every purpose

High or Low Pressure—Small or Large Capacity Hot or Cold—Water or any other Liquid.

We have sold thousands of pumps for nearly every purpose, from the small cutting fluid circulating pump to the large million gallon heavy duty pump for Municipal Water Service.

Put your pumping problem up to our special representatives. We can supply a pump that will exactly fill your requirements.

The Canadian Fairbanks-Morse Co., Limited

"Canada's Departmental House for Mechanical Goods"

DEPARTMENTS

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Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria.

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

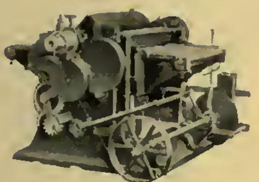

Crescent Wood Working Machinery

Quality and Price Both Right

CRESCENT machines are built to satisfy the demand of those particular users who want the best wood working equipment at a price that is fair to the manufacturer and just to the buyer.

Send to-day for complete catalog describing band saws, jointers, saw tables, shapers, variety wood workers, planers, planer and matcher, swing saws, cut-off table, disk grinder, borers, hollow chisel mortiser, Universal wood workers.








The Crescent Machine Co.

361 Somer Street - Leetonia, Ohio

FOR SALE BY

THE CANADIAN FAIRBANKS-MORSE COMPANY, LIMITED

Halifax St. John Quebec Montreal Ottawa Toronto Hamilton Windsor Winnipeg Saskatoon Calgary Vancouver Victoria





CANADIAN FAIRBANKS-MORSE
EVERYTHING MECHANICAL

This Tool

was tested in a well-known plant in New York

It is a Davidsonized milling cutter, 4" diameter by ½" face. Run at a speed of 250 R.P.M., and with a feed of 7" per minute, taking a cut ½" wide by ½" deep, it worked without any difficulty for ONE HOUR AND THIRTY-TWO MINUTES.

As against this, a high-speed steel milling cutter of one of the best-known makes, and also a cutter made from one of the best-known high-speed steels, ran under the same conditions for TWENTY-EIGHT MINUTES. At the completion of the test the Davidsonized cutter was in better condition than either of the other two tools.

The material tested was .45% Carbon Open Hearth Steel, containing .70% Manganese.

*Name on request.

You Can't Get Away From Facts Like These

We claim that it is possible in a majority of instances to obtain similar results.

Davidsonized High Speed Steel

offers you great opportunities for increased production, long service and tool-making economy. We guarantee any tool of Davidsonized High Speed Steel to give you at least 10% better service than any other tool you have been using on corresponding work. You will be the sole judge. More and more of the leading machine shops are turning to this steel of remarkable service, because—

(1) It increases production 10% or more. Such an increase, figuring factory overhead and labor, multiplies several times over the value of the tool.

(2) The guarantee above gives absolute protection.

(3) Davidson Special Service cuts tool-making time and tool-room costs.

SPECIAL SERVICE

We will supply Davidsonized Tools, semi-finished and easier to machine than any carbon tool steel, within approximately 1/64 of finish on face, 1/64 in bore and 1/32 in diameter, leaving only the final hardening and sharpening to be done in your tool room. A tool that takes 20 hours to make from the solid bar can easily be finished from a Davidsonized blank in about two hours. And we will guarantee our tools against breakage in hardening.

This service, though it applies also to standard tools, is especially desirable in the case of tools made to unusual shapes and other specifications.

Use this special service. It costs you less than to bring your tools from the bar to the stage at which we furnish them. It eliminates the loss by breakage in hardening. And, most important of all, it gives you better tools than you have been using, tools capable of such performances as the one described above, tools that will boost your production and give you longer service. Send us a trial order; our guarantee prevents all risk. Correspondence invited.

THE DAVIDSON TOOL MFG. CORPORATION

Head Offices: 118-122 Maiden Lane, New York **Works: 56-62 North 6th St., Brooklyn, N.Y.**

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Vancouver, Victoria

Mark Your Products The "MATTHEWS" Way

"Matthews-made" steel stamps and lettering dies make easily read and durable marks on all classes of products. Matthews Champion Type Holders—for flat and convex surfaces—with Interchangeable Steel Type, save time and lower marking costs. Matthews Inspection Hammers, of best Pittsburgh Steel, are fashioned with the "know how" of over 50 years' experience.

Jas. H. Matthews & Co., Inc.
PITTSBURGH, PA.

Steel Lettering, Dies and Stamps

CANADIAN FAIRBANKS MORSE
EVERYTHING MECHANICAL

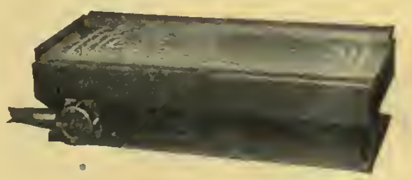
"D & W"
Magnetic Chucks

Heat-proof - Oil-proof - Waterproof

"D. & W." Magnetic Chucks are designed to secure the maximum effective holding surface, with exceptionally strong and uniform pull throughout, whereby a wider range of work can be machined than was formerly practicable.

The magnet coils in "D. & W." Chucks are wound and insulated by a special process which protects them from heat and moisture.

All chucks are equipped with special enclosed type demagnetizing switches, for automatically releasing the work.



We also manufacture a complete line of specialties, including taper, swivelling chucks, and A.C. and D.C. Demagnetizers. Prices quoted upon application.

"D. & W." standard flat and rotary chucks are designed for use on either 105-125 volt or 210-250 volt D.C. circuits, but not on both ranges. In ordering chucks specify voltage of lighting circuit. Alternating current cannot be used.

D & W Fuse Company
Providence, R.I.
U.S.A.

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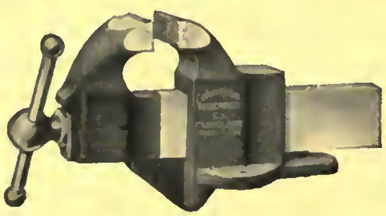
EVERYTHING MECHANICAL

COLUMBIAN

Sledge-Tested VISES



All Good Points In One Vise

NO matter what other make of vise you favor you'll find its best features in Columbian Sledge-Tested Vises — and in addition, many good points of its own.

Some men select a vise for deep jaws. Others want a vise with removable steel jaw facings. Still others attach most importance to simple, quick-acting adjustment of jaws or swivel base.

Columbian Sledge-Tested Vises will give you all of these and in addition an unbreakable vise. Columbian is the only hollow-jawed malleable iron vise made. You can hammer it with a 16-pound sledge and not break it. It is twice as strong as a cast iron vise and you can obtain a Columbian Vise in any style or size you want at the same price you'd pay for an old-style vise.

The makers of Columbian Sledge-Tested Vises are the largest makers of vises in the world. A thousand jobbers and mill supply houses sell Columbian Vises.

Write for catalog and name of dealer in your town

The Columbian Hardware Company

World's Largest Makers of Vises and Anvils

CLEVELAND, U.S.A.

BURKE BENCH MILLING MACHINE No. 3

Power, speed and accuracy are combined in this compact and convenient small machine. Carefully designed, well balanced and well built — equipped with slotting attachment, index centers, milling attachment, etc.

This Burke No. 3 is a pace setter wherever it is installed.

We make Milling, Drilling and Tapping Machines, Cutting-off Saws, etc.

Catalogue?

BURKE MACHINE TOOL CO.

CONNEAUT, OHIO

For Sale by The Canadian Fairbanks-Morse Co., Limited

Canadian Fairbanks-Morse Trade Mark

A Strong Right Hand with a Scale Test Weight. Symbolizing a well-knit human organization upholding a well-balanced mechanical business

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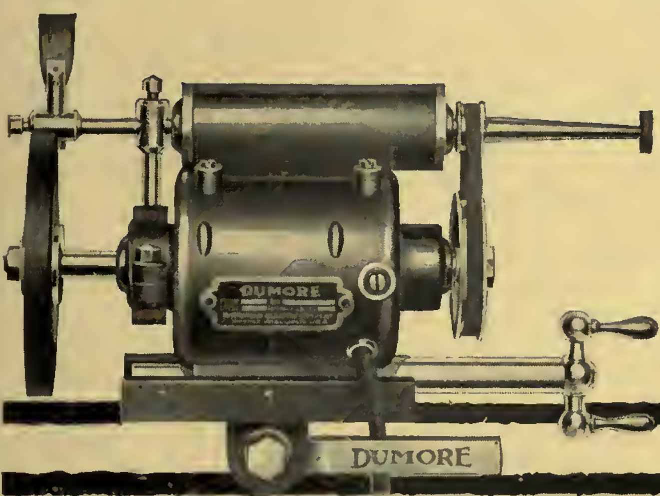

Just What You Need For Grinding Your Hardened Tools

Mechanics everywhere specify the DUMORE when buying grinding equipment because of the tool's reputation for service and satisfaction. It easily handles all kinds of work—longitudinal, cylindrical or internal.

Because each armature is dynamically balanced, the high speeds of the DUMORE, ranging from 10,000 to 50,000 R.P.M., are found not only practical, but indispensable to correct cutting speeds for small emery wheels. Jobs are consequently free from danger from chatter, taper or bell mouth.

Let us demonstrate what a big saving you can realize with a DUMORE grinder in your shops.

Wisconsin Electric Co.
2907-16th St., Racine, Wis., U.S.A.

DUMORE HIGH SPEED GRINDERS

CANADIAN FAIRBANKS-MORSE
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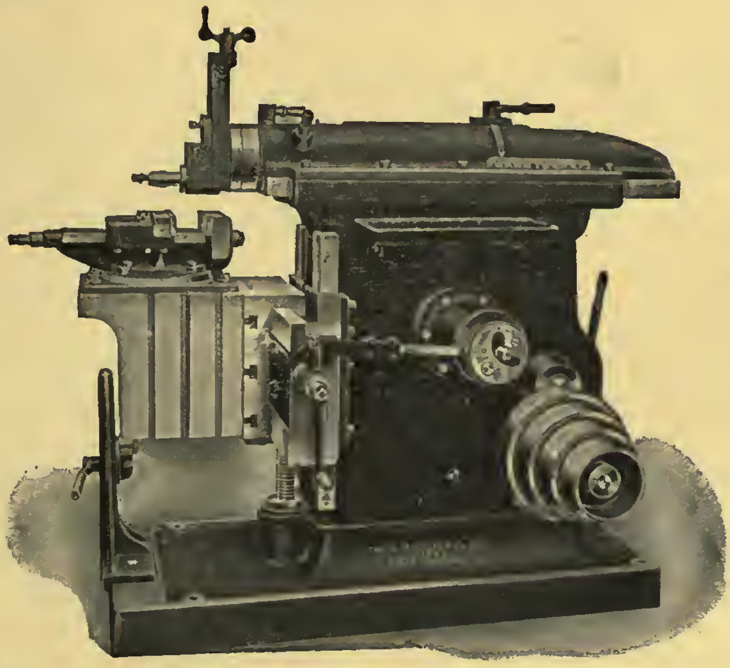

McDougall Shapers

Built to conform to the demands of a modern shop. Simplicity in the design and convenience of adjustments gives the operator every facility for ease of operation and accuracy in work.

Our circulars, containing complete specifications and descriptions, are ready. Write us for one.

The R. McDougall Company, Limited

Manufacturers
Galt, Ontario
Canada

The Canadian
Fairbanks-Morse
Company, Limited
Sales Agents

ARE-MAC-DEE IS A GUARANTEE

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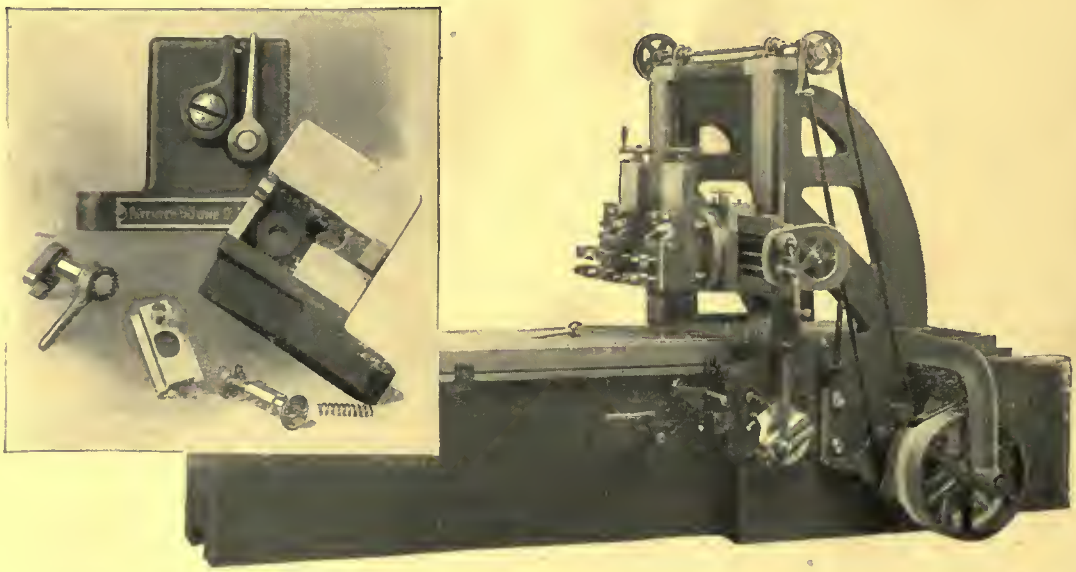
Distinctive Features that Build Speed Into Whitcomb-Blaisdell Planers



The Patented Self-Locking Shipper Dogs

Provide Quick and Easy, Yet Safe Adjustment of Table Travel.

Finger pressure upon the small lever releases the shipper dog for shifting. When slid into the desired position, the releasing of the lever locks it instantly and automatically.

No wrenches are required for adjusting these shipper dogs. No time is wasted; only a moment is required for positioning the table travel just as required by the work.

The danger of the operator being caught between the table and the housing of planer, while changing the stroke, is entirely eliminated.

This is typical of the many provisions for rapid adjustments on the Whitcomb-Blaisdell Planer.

It is not alone the extremely high cutting speeds, permitted by the Patented Second-belt Drive, which makes the Whitcomb-Blaisdell Planer so productive. Hardly less important a factor is the completeness of its provisions for speed in adjusting and operating.

Write for our latest Catalog, which tells in detail all the reasons for Whitcomb-Blaisdell Planer Speed.

LATHES From 14" to 30" SWING

WHITCOMB-BLAISDELL
MACHINE TOOL CO.
WORCESTER, MASS., U.S.A.

PLANERS From 17" to 48" WIDE

For Sale by The Canadian Fairbanks-Morse Co., Limited

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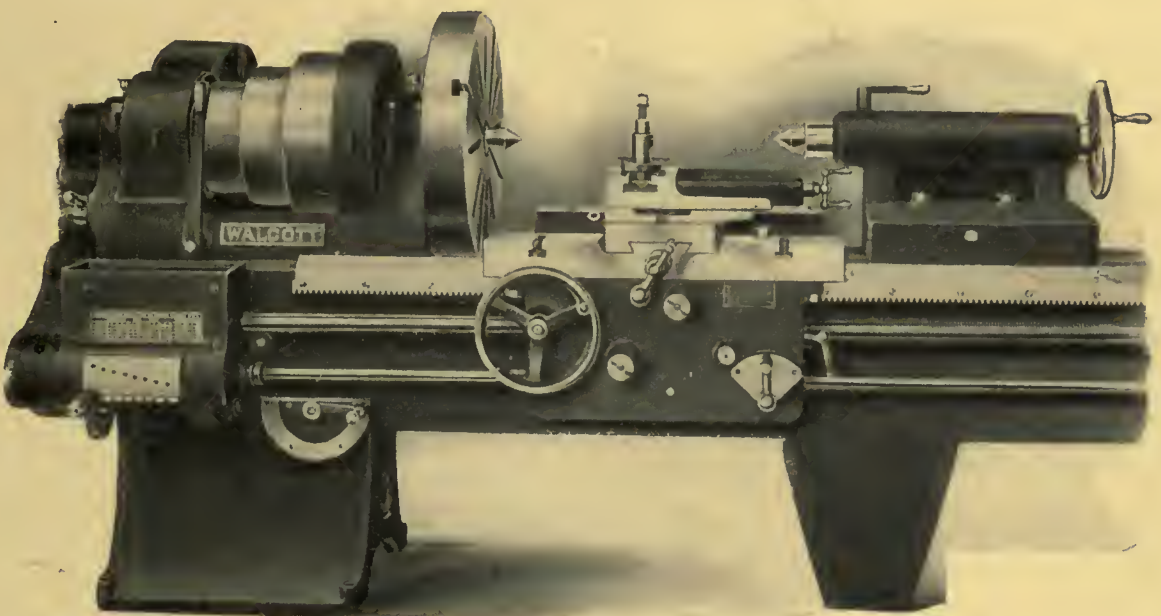


THE WALCOTT LATHE

Promises or Actual Performances?

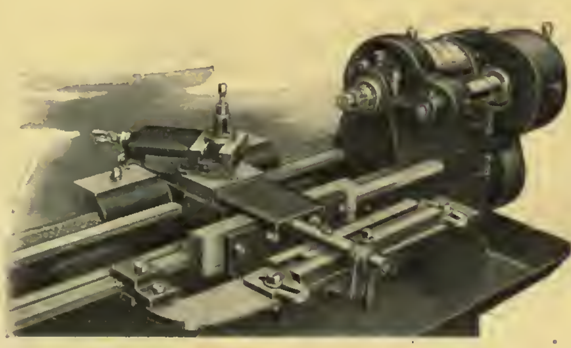
A new product may survive for a time on promises for the future, but an old one can only justify itself on records already achieved.

For the past 38 years Walcott Lathes have proved their ability in **actual service.** In the present emergency they have risen to the occasion, and for a production Lathe, they have a remarkable speed and accuracy.

Walcott Lathes have a compound rest which has no overhand, and is as stiff as any plain rest. A quick-change gear box, unusually wide bearing surfaces on the bed, exceptionally wide bridge to carriage, and many other features we have added during the 38 years Walcott Lathes have been on the market.

Made in 14", 16", 18", 20", 26" and 29" sizes.

Write for full details.



Walcott Taper Attachment

Made by the Walcott Lathe Company

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THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

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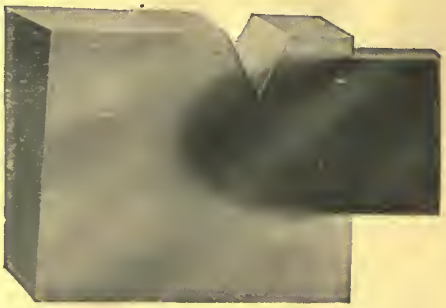
Fairbanks-Morse

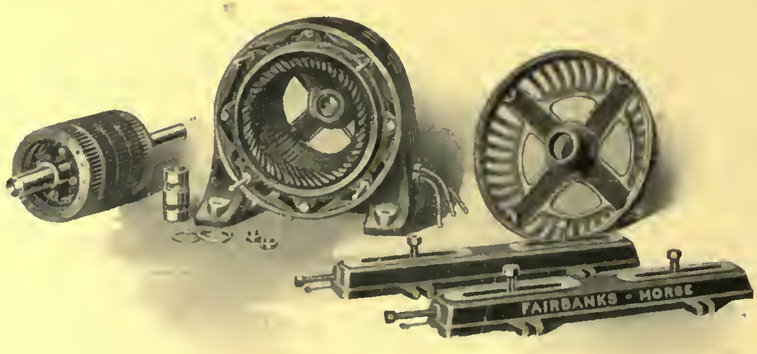
Plain Bearing Induction Motors *Ball Bearing*



A cut section of End Ring and Bar showing the perfect joint.

Sturdy Construction—Efficient Operation

No Joints in the Rotor—the end rings are *cast* in place. We recommend particularly the Ball Bearing Motors. They save money. They are efficient and clean. They require only occasional lubricating with grease. The motor may be mounted on wall or ceiling without changing the motor frame—The Ball Bearings have no distinct top and bottom.



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"Canada's Departmental House for Mechanical Goods"

St. John, Quebec, Montreal
Windsor, Winnipeg,
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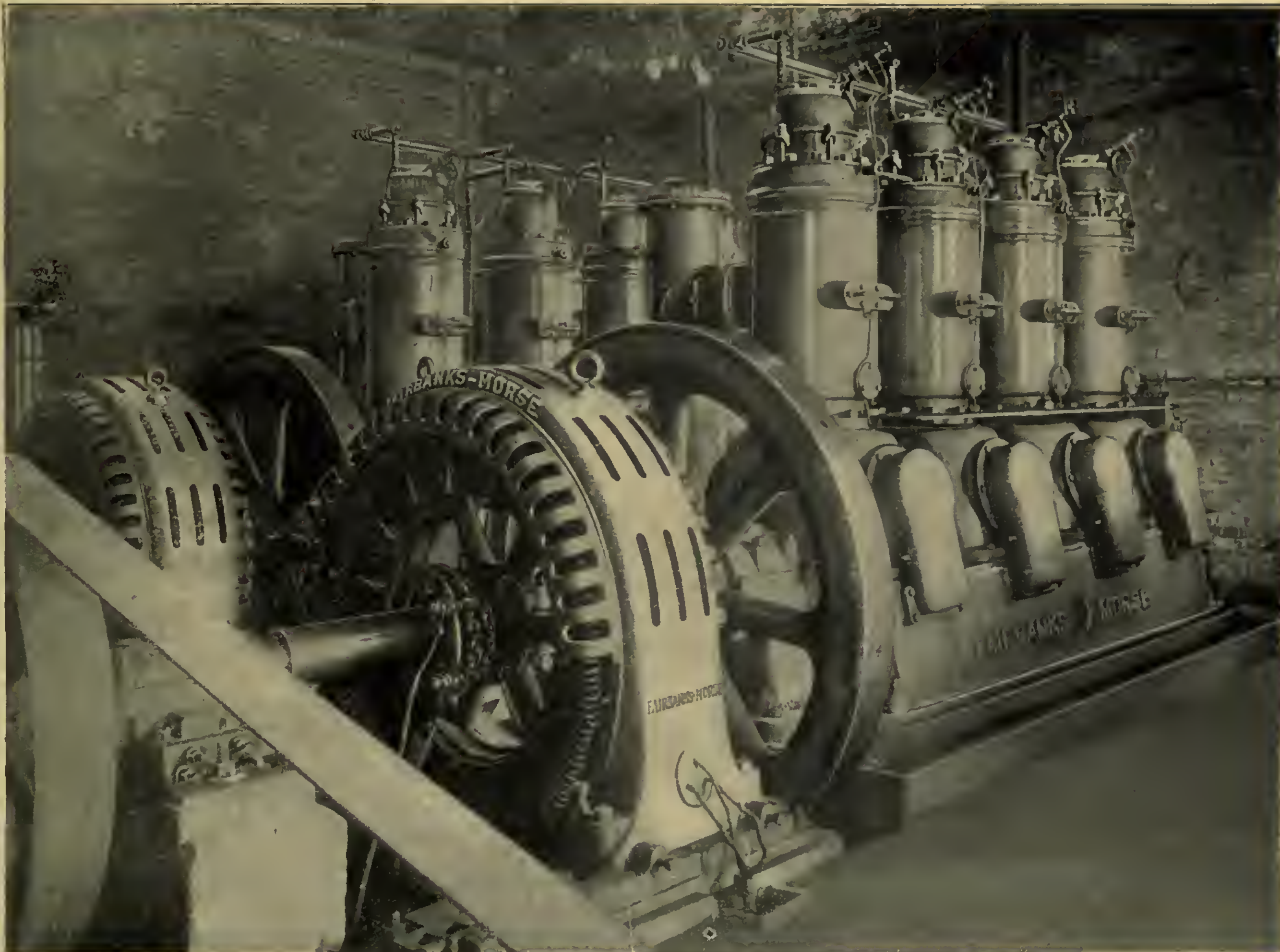
Ottawa, Toronto, Hamilton
Saskatoon, Calgary,
Victoria



Does Your Coal Pile Seem Small and Expensive?

Then the most necessary thing is ECONOMY, not only in its use, but of every pound of steam that your coal produces.

Avoid all leaking steam at the stuffing boxes, no matter how small, by using a rod packing that has great staying qualities.
You can depend upon

TRADE MARK
"PALMETTO"

Working samples to prove quality. Send for them. No charge.

because the materials of which it is made have the great tensile strength found only in first quality. The abundant lubricant in each single strand greatly adds to its life by keeping the rod constantly lubricated.

GREENE, TWEED & CO.

109 Duane Street SOLE MANUFACTURERS NEW YORK

Canadian Agents:
The Canadian Fairbanks-Morse Co., Limited, St. John, Toronto, Quebec, Hamilton, Montreal, Ottawa, Vancouver, Victoria.

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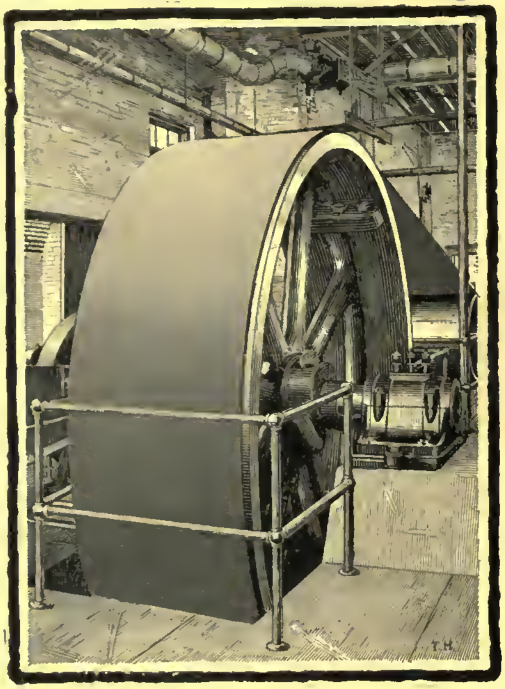
FAIRBANKS
RENEWABLE DISC VALVES

WOULD REDUCE YOUR VALVE EXPENSE EVEN THOUGH THEY COST DOUBLE THE PRICE. THE BAKELITE DISC GIVES MAXIMUM SERVICE UNDER ALL CONDITIONS OF STEAM, AIR, AND WATER. WHEN THE DISC DOES WEAR OUT, IT CAN BE REPLACED IN LESS THAN ONE MINUTE WITH ONLY ONE TOOL—A WRENCH TO REMOVE THE BONNET.

SPECIFY FAIRBANKS VALVES ON YOUR ORDER.

The Canadian Fairbanks-Morse Company, Limited

Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria



Put a Belt as Good as this on *Your* Pay-roll

This Graton & Knight 40" 3-ply Heart Brand Belt is five years old. It is running every day on heavy duty for the Milford Light and Power Co., Milford, N.H. The cost of this belt in cash has been $1.81 a week, or .004 per delivered horse-power per week.

Put a belt as good as this on your pay-roll. Its low cost of upkeep is the result of Graton & Knight Standardization. That means the proper belt for any given requirement. It means the right quality of leather and the right kind of tanning for a given purpose. It means true economy—full delivery of power, without waste.

Leather is the ideal belting material. It has a characteristic pulley-gripping quality. It has pliability with light weight. It has the stretch and the come-back that gives and takes. It stands mauling by shifters and the gruelling strain of main drives. It is firm and strong. It is tough, but tractable. These are the characteristics that good belting must possess.

Every year nearly 300,000 hides are tanned in the G. & K. factory. That gives uniformity. The more stock handled, the more latitude there is for picking equal-quality material for a given specification. And G. & K. Tanning is of a fixed standard of quality for specific requirements. We make all kinds of leather belting, for every use—large and small.

Load carried and conditions of operation must figure largely in the length of service of any belt. Some drives limit belting to a few months or even a few weeks. Graton & Knight Standardized Series Belts are made to give the longest possible delivery of efficient power at the lowest possible cost. And they do it. It may be that belts all look alike to you—and it may be that you are spending more than is necessary for some belting requirements. We can and will help you find out.

Many of the best-belted plants ask us to specify the belting for every drive. Try the plan yourself. Then, when buying, call for "Graton & Knight——Brand or equal" This won't commit you to buying our belts. It will put your buying on the one basic consideration—the work to be done.

Write for new book about Standardized Leather Belting

THE GRATON & KNIGHT MFG. COMPANY, Worcester, Mass., U.S.A.

Oak Leather Tanners, Makers of Leather Belting, Lace Leather, Packings, and Specialties

Canadian Graton & Knight Ltd., Montreal, Canada

Canadian Representatives: The Canadian Fairbanks-Morse Co., Ltd., St. John, Montreal, Ottawa, Toronto, Hamilton, Quebec, Calgary, Saskatoon, Vancouver, Windsor, Winnipeg, Victoria.

GRATON AND KNIGHT

GRATON AND KNIGHT

GRATON & KNIGHT

Standardized Series

LEATHER BELTING

Tanned by us for belting use

CANADIAN
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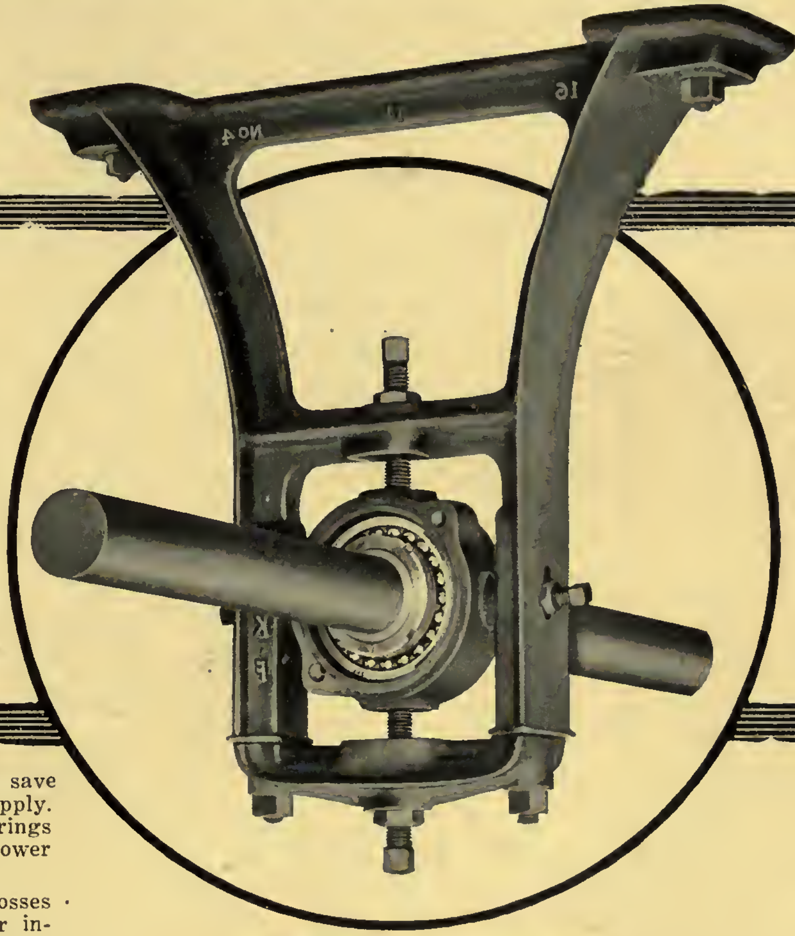


Supporting the Line of Industry

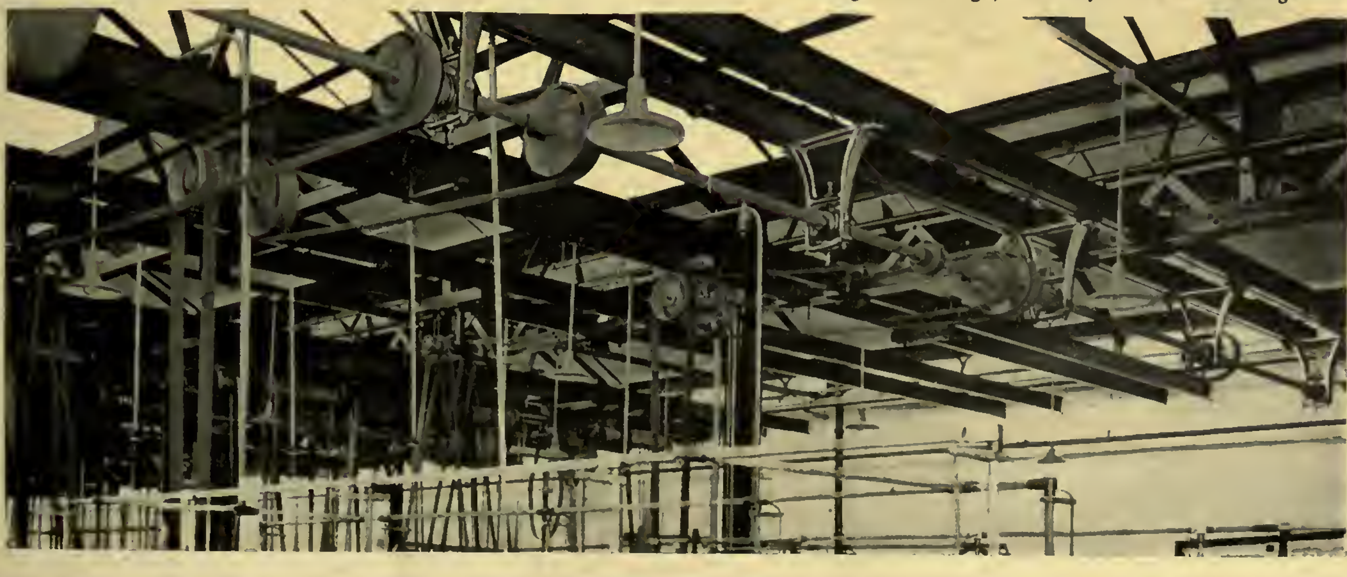
The industrial problem of the day is how to save power and conserve the diminishing fuel supply. Transmission losses due to friction of plain bearings amount to from 20% to 40% of the total power used in the plant.

SKF Ball Bearing Hangers will reduce these losses over 33%. This saying alone will make their installation a profitable investment. Then, too, the lubricant savings and the impossibility of hot bearings is an item to consider.

We have a special catalog describing their use in your line of business. Send for a copy.

CANADIAN SKF COMPANY
LIMITED
TORONTO, ONT. 128 Coristina Bldg., Montreal, Que.
Canadian Agents:
THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
St. John Quebec Montreal Ottawa Toronto Hamilton
Windsor Winnipeg Saskatoon Calgary Vancouver Victoria

SKF
BALL BEARINGS
Automatically self-aligning and fitted in oil-tight housings, which prevent oil leakage



CANADIAN
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EVERYTHING MECHANICAL

Manufacturing Plant Equipment

- G. & K. Leather Belting
- Dick's Balata Belt
- Cotton and Rubber Belt
- Lacings and Fasteners
- Belt Tools and Lacing Machines
- Belt Clamps
- Shafting
- Collars
- Plate, Compression and Flexible Couplings
- Hangers
- Pillow Blocks
- Floor Stands
- Wall Frames
- Wood Pulleys
- Steel Pulleys
- Cast Iron Pulleys
- Friction Transmission
- Variable Speed Transmission
- Belt Tighteners
- S K F Ball Bearings
- U. G. Friction Clutches
- Cut-off Couplings
- Silent Chain Drive
- Rope Transmission
- Babbitt Metal
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- Sprocket Chain
- Spur and Bevel Gears
- F. M. Motors
- Motor Generator Sets
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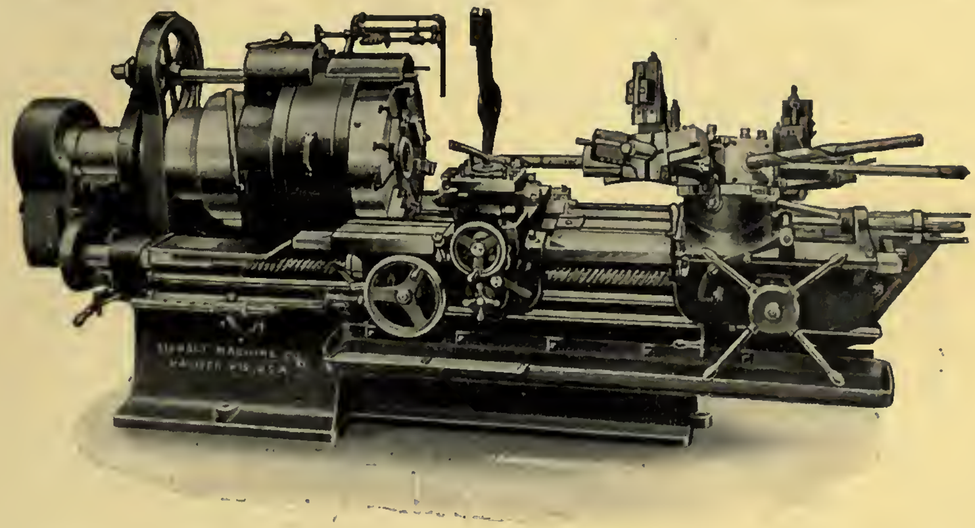

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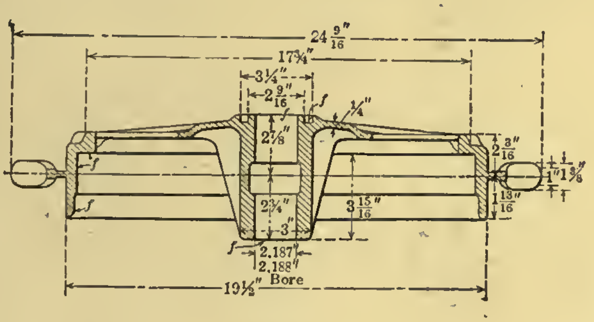

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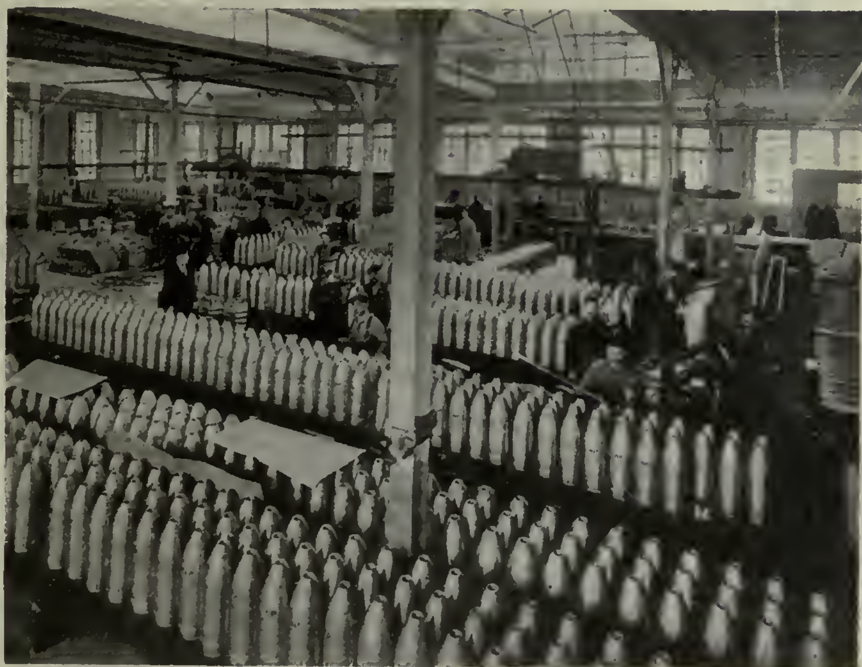


CANADA MADE A REMARKABLE RECORD IN PRODUCTION OF MUNITIONS

Canadians Undertook Work of Mastering New Industry and Succeeded

By T. M. FRASER, Ottawa Representative MacLean Papers

OTTAWA, December 26.—Among the romances of commerce which the war has produced in Canada, there is none more striking than the organization and work of the Imperial Munitions Board, which, in the three years of its operation, furnished to the Ministry of Munitions and other departments of the British Government, Canadian manufactures to the value of one billion, one hundred million dollars. This enormous commerce was developed literally from the ground up, because, prior to the beginning of this war, there was no munitions industry in Canada, or no thought that such an industry was capable of any serious development. Mr. Churchill might well say, as he took the earliest opportunity to do in a handsome acknowledgment of the work of the Munitions Board on the cessation of hostilities, that "Canada's remarkable output of munitions has played a large part in the munitioning of the British armies, and will remain a testimony to the high value of the work of the Board in this great struggle"; a tribute in which Premier Lloyd George coupled the staff of the Board, the Canadian manufacturers, and the great army of workers who so splendidly assisted.

As a matter of record, it might be noted that the first shells made in Canada and shipped from a Canadian plant, outside of a few at the Quebec arsenal, were made at the C.P.R. shops at Montreal, and this was mainly due to the keen personal interest taken in the matter by Lord Shaughnessy. The British army tried them and pronounced them good. Then small orders began to come in from Great Britain, and the manufacturers got interested. Gradually orders came for the larger shells. No order, great or small, was ever turned down.

The second plant to take up the work was the Ingersoll-Rand Drill Company at Sherbrooke. Although no Canadian manufacturer had ever previously made a shell, or a cartridge case, or a fuse, they were willing to try. In December, 1914, there were two firms shipping; January, 1915, 8 firms; April, 1915, 14, and in June, 1915, 36 firms, with an average weekly production of 77,000 shells. The maximum point in the industry was reached in June. 1917, when 53 firms were engaged in the work, with an average weekly production of 386,000 shells.

A few 13 and 15 pound shells were made at first, but serious production was early directed to the 18-pound shrapnel. In fact, while the industry was handled by the Shell Committee, which it was for the first fourteen months, it was mainly engaged in the production of 18-pounders and high-explosive. Cartridge cases and some other component parts were also produced in small quantities, but no complete rounds.

Working Under Adverse Conditions

The Shell Committee had done good work. It broke the ground, and was instrumental in inducing Canadian manufacturers to engage in the new industry, which many of them were loath to do. In the criticisms which were so freely made of both the Committee and the manufacturers, little thought was given to the conditions under which they were operating. To engage in the work meant practical abandonment of the plant and organization which they had built up, to engage in a work which was unknown to them, and to embark their capital in an industry, the life and death of which was uncertain. This was a time, it should be remembered, when men were predicting an early end to the war. Under such conditions no one would be likely to engage on what all admitted was a very necessary work except at a rate of profit higher than normal.

Criticism was not lacking. It was painful and frequent and free in public, press, Parliament, and even in the pulpit. The result was that the existing arrangement became unsatisfactory to all concerned. The Shell Committee went out of business after having been responsible for about 3,800,000 shells, and its place was taken by the Imperial Munitions Board.

Turned to a Real Autocracy

The organization of the Shell Committee had been democratic, and like many of the creations of democracy, it had failed to give satisfaction to its creators. The Imperial Munitions Board was a pure autocracy. Final authority and responsibility was vested in the chairman, Sir Joseph Flavelle, the other members of the Board being: Brigadier-General Sir Alexander Bertram, vice-chairman; R. H. Brand, representative of the Board at the Ministry of Munitions, London; Col. D. Carnegie, ordnance adviser; G. H. Dawson, Brigadier-General W. E. Edwards, R.A., director of inspection (Canada); F. Perry, financial member; J. A. Vaillancourt; E. R. Wood. Sir Charles Gordon was representative of the Ministry of Munitions in Washington. The Board was an integral part of the British Ministry of Munitions, directly responsible to the Minister, and the British Government was financially responsible for all its expenditure, although the Government and the banks of Canada advanced three-fifths of the total sum expended.

The Imperial Munitions Board took over the work in November, 1915, when the demand for shells was still small in comparison with what it soon became. The development of the systems of barrage and intensive bombardment created a new problem for the munition makers, creating a demand for shells never hitherto dreamed of as possible. Canada was asked for six, eight, and nine inch high-explosives, and also for the component parts to produce complete rounds, and the Ministry of Munitions seemed to have a considerable degree of confidence that it would get them. It was waking up to the possibilities of Canada as a source of supply, and the Canadian manufacturers were waking up to their own ability.

The Work of Organization

All this meant something very much more intricate and elaborate than any problems which the Board had hitherto encountered. It was seen that the work must be allocated among the forty or more firms which had by this time gons into munition making, and that provision must be made for controlling their supply of raw materials and machinery as well. The motto of the Board became: "From each one according to his ability; to each one according to his needs." This was good for both the Government and the manufacturers; it regulated supplies and stabilized prices both of raw material and of the finished product.

A purchasing department was organized to supply the manufacturers with their raw materials; a distribution department which directed the supply of the same to the best advantage, and a production department which had supervision of manufacture, and rendered expert advice and any other assistance required. There was also a labor department for the supply of help to the plants, and an inspection department who work was of the most vital importance and assistance, not only to the Government, but to the manufacturers as well. The inspection department had as many as eight thousand persons on its pay roll.

The organization of the Board was well-nigh perfect. It summoned to its assistance, in one capacity or another, the best brains and skill available, and it worked in the utmost harmony. It may be imagined that any organization having in its hands an expenditure of over a billion dollars early attracted the notice of the birds of prey. Graft, like death, loves a shining mark, but the men at the head of it were determined that the British taxpayer, who was paying a fair price for what he was buying, should receive full value for every cent of that billion dollars, and it was not long before the fact was fully understood that the Board was not a mark for anyone. After that it was left severely alone by all except legitimate business men, and they have always been glad to do business with it.

Newspapermen may, perhaps, have a slight grudge against the Board. It was almost barren of information. It did not seek publicity; in fact its business was of a kind where the utmost secrecy as to its operations had to be maintained. It is notable that in all the time its mommoth operations were being conducted there was never a "leak" of any kind. All that was being known was that the Board was producing the goods not only to the satisfaction of the Ministry of Munitions, but to its surprise and delight.

Went Into All Phases of Work

The mere manufacture of shrapnel shell was an accomplishment in itself, but it was slight in comparison with the work involved in furnishing the complete munitions. This meant buying steel, copper zinc, lead and antimony. The steel had to be rolled into bars, the bars forged into shells, and the forgings machined. The copper and zinc had to be made into brass, the brass into discs, and the discs into cartridge cases. The lead and antimony became bullets. and the bullets produced "good" Germans. Explosives had to be made or bought and filled into shells, fuses, or cartridge cases.

Existing plants could not cope with the Board's demands, so it built plants of its own—enormous plants. The fuse plant at Verdun; the British Forgings at Toronto; the explosives plants at Renfrew, Nobel and Trenton; the aeroplane plant at Toronto—when you examine the perspective drawings of them on the walls of the Munitions Board offices at Ottawa, you wonder at the energy and organizing ability which made these modern forges of Vulcan spring up overnight. If you were a German you would say: "An enemy hath done this thing, and you would have as much respect for the Canadians who were behind the man behind the guns as for those who aimed and fired them. Once, when Randolph Churchill tried to hold up a Government of which he was a member, he found his plans upset by reason of the fact, as he said, that he "forgot Goschen." One of the factors the Kaiser failed to take into account when he started to upset the world, was little one-horse Canada.

And this is not mere braggadocio, either. When Randolph Churchill's son cabled his congratulations the other day, he had in mind the fact that in the second half of 1917 Canada was producing 55 per cent. of the shrapnel, 42 per cent. of the 4.5, 27 per cent. of the 6 inch, 15 per cent. of the eight inch, and 16 per cent. of the 9.2 inch shells used by the British armies. Wilhelm remembered Canada then. In addition to the munitions for the British Government, the Board at different times was filling orders for the Italian, Russian, and Belgian Governments, and when the war was ended, was handling very large orders for the United States.

Conditions Better Than in States

One of the surprising features of the war has been the comparative failure of our neighbors in certain particulars wherein they have always been reputed to be notably strong, and the display of an unlooked for moral strength. The failure of the United States in the matter of munition and aeroplane production as compared with Canada's handling of the same problems, was as pronounced as their superiority over us in the matter of solving the conscription problem, or the handling of the I. W. W. and other revolutionary malcontents. The dislocation of the ammunition and aeroplane programme with our neighbors appears to have been largely due to a lack of co-ordination of the manufacturing end, a problem which, as already mentioned, was solved here very early by the Board, when it organized its purchasing, distribution, and production departments, and itself took in hand the centralizing of the supply of raw materials. It is a very fine thing that two good neighbors should be able and willing to learn from each other and profit by each other's successes and failures, and this we have both done.

The activities of the Board were not confined to the production of war materials. They showed such a willingness to take on new problems and handle them successfully that the British Ministry of Shipping asked for aid, and at the end of 1916 they had begun placing orders for steel ships and reviving the wooden shipbuilding industry in Canada. They placed orders for 215,000 deadweight tons of steel ships in all, and undertook the construction of 140,000 tons of wooden steamships. The wooden shipbuilding industry, in which Canada was once a leader, had fallen so low that it was confined to the construction, mainly, of small coasting and fishing ships on the Atlantic and Pacific coasts. In Eastern Canada the Board arranged for the building or expansion of eight yards, and on the Pacific it took over two yards and constructed four more. The impetus thus given to the industry has led to a wonderful expansion on both coasts, and while wooden ships may never come back permanently, they have filled a great need, and will probably continue to do so for some time to come.

When aeroplanes and aeroplane spruce became a crying need of the Allies, this "Handy Man" of the British Government was again ready to step into the breach. They have managed all the business and construction side of the Royal Air Force in Canada, which, when peace came was producing air fighters at the rate of between three and four thousand a year, as well as large numbers of machines to fly and fight in. The Allies wanted spruce, which is the best wood for aeroplanes, and Canada had lots of it. The Board sent one of its experts, Major Austin Taylor, to the Pacific Coast to assist the lumber producers in securing it, and it was not long before this problem was satisfactorily settled.

Here Are Some Huge Totals

We can't get away from figures where the Munitions Board is concerned. It has created a new standard for Canada in the way of big figures. It put us on the map as a billion dollar manufacturing concern. Here are some of the Board's records, approximately:

The following figures give a summary of Canada's accomplishments, during the last four years, in the production of munitions of war, referring especially to the British contracts:—

Total number of shells produced	65,000,000
Approximate number of components represented by above, for which Imperial Munitions Board has let separate contracts	800,000,000
In addition to the 60,000,000 of shells produced, there have been a great number of components exported, such as forgings, cartridge cases, primers, copper bands, time and graze fuses, exploder containers, friction tubes, etc. In the production of this war material steel has been used to the amount of, tons	1,800,000
(About 75% of this steel is Canadian product).	
Quantity of high-grade explosives and propellants produced, lbs.	100,000,000
Value of orders placed by the British Government through the Imperial Munitions Board	$1,200,000,000
Amount furnished by Imperial Government for above purpose from sources outside of Canada	$400,000,000
Amount loaned to the Imperial Government by the Government of Canada and by the Banks in Canada for purposes of the Imperial Munitions Board	$600,000,000
Approximate number of contractors in Canada amongst whom contracts for munitions have been distributed	1,000
Number of workers engaged in war contracts	200,000-300,000
Approximate number of persons employed in handling stores in transportation and other collateral organizations	50,000
Approximate total number of workers	350,000

The List of British Contracts

CANADIAN MACHINERY was able to secure, through the courtesy of the Imperial Munitions Board at Ottawa, the following figures of total production in the various plants:—

Eight-Inch High Explosive

	Complete No.
Bertram & Sons, Dundas, Ont.	64,500
Can. Bridge Co., Walkerville, Ont.	60,690
Can. Fairbanks-Morse, Toronto	149,796
Can. Ingersoll-Rand, Sherbrooke, P.Q.	187,451
Dominion Bridge Co., Montreal	19,703
Gurney Foundry Co., Toronto	49,866
Montreal Tramways, Montreal	49,915
T. McAvity & Sons, St. John, N.B.	5,919
N. S. Steel & Coal Co., New Glasgow, N.S.	2,127
Russell Motor Co., Toronto	9,005
Standard Steel Construction Co., Welland, Ont.	24,953
Universal Tool Steel Co., Toronto	129,999
Total	753,924

9.2 High Explosive

Amalgamated Amm. Machine Co., Toronto	30,009
Canada Cement Co., Montreal	254,998
Dominion Steel Products Co., Brantford	64,997
Fisher Motor Co., Orillia, Ont.	66,005
Leaside Munitions Co., Toronto	79,064
T. McAvity & Sons, St. John, N.B.	41,086
N.S. Steel & Coal Co., New Glasgow, N.S.	13,687
Russell Motor Car Co., Toronto	74,675
Steel Co. of Canada, Montreal	60,004
St. Lawrence Bridge Co., Montreal	100,009
Total	784,534

Six-inch High Explosive

Bell Engine & Thresher Co., Seaforth, Ont.	166,272
Bertram & Sons, J., Dundas	215,122
Can. Blower & Forge Co., Kitchener, Ont.	49,002
Canadian Bridge Co., Walkerville, Ont.	103,071
Canada Cement Co., Montreal	352,129
Can. Fairbanks-Morse, Toronto	419,864
Can. Ingersoll-Rand Co., Sherbrooke, P.Q.	421,403
Can. Linderman Co., Woodstock, Ont.	78,982
Can. Tube & Iron Co., Montreal	348,343
Consol. Steel Co., Toronto	300,570
Dominion Bridge Co., Montreal	656,207
Eaton & Sons, J. R., Orillia, Ont.	88,770
Fisher Motor Co., Orillia	114,962
Gen. Car & Mach'y Co., Montmagny, P.Q.	225,840
Gurney Foundry Co., Toronto	151,703
Hayes Wheel Co., Ltd., Chatham, Ont.	140,862
Hepburn Co., J. T., Toronto	116,676
Hope & Sons, Ltd., Henry, Toronto	202,560
Jenckes Machine Co., Sherbrooke, P.Q.	54,307
Leaside Munitions Co., Toronto	724,719
Long Mfg. Co., E., Orillia, Ont.	124,475
Lyall & Sons Construction Co., P., Montreal	1,314,477
Midland Engineering Works, Midland, Ont.	183,076
Modern Tool Mfg. Co., Montreal	254,555
Montreal Locomotive Works, Montreal	749,508
Montreal Tramways Co., Montreal	56,608
Munitions & Metal Products, Peterborough	220,545
McKinnon Industries, Ltd., St. Catharines, Ont.	301,767
McLennan Foundry & Mach. Works, Campbellton, N.B.	71,593
National Mfg. Co., Ottawa and Brockville	245,525
National Steel Car Co., Hamilton	3,282
Page-Hersey Iron Tube & Lead Co., Guelph	144,390
Pease Foundry Co., Toronto	127,731
Pembroke Iron Works, Ltd., Pembroke, Ont.	339,502
Peterboro' Machine & Lub. Co., Peterboro'	35,714
Quinlan & Robertson, Ltd., Campbellford, Ont.	76,583
Russell Motor Car Co., Toronto	204,493
Savoie-Guay Co., Montreal	70,405
Spramotor Co., London, Ont.	95,837
Steel & Radiation, Ltd., Toronto	387,206
St. Catharines Steel & Metal Co., St. Catharines	309,573
St. Lawrence Bridge Co., Montreal	175,930
St. Lawrence Iron Foundry, Montreal	209,399
Taylor-Forbes Co., Guelph, Ont.	142,157
Three Rivers Indus. Co., Ltd., Three Rivers, P.Q.	42,226
Universal Tool Steel Co., Toronto	230,221
Total	11,048,578

13 lb. Shrapnel (1915)

Canadian Vickers, Ltd., Montreal	79,550

15 lb. Shrapnel (1915-16)

Can. Crocker Wheel Co., Ltd., St. Catharines	66,193
Can. Westinghouse, Ltd., Hamilton	15,247
Dominion Bridge Co., Montreal	26,163
Electric Steel & Metals Co., Ltd., Welland	180,065
Inglis Co., Ltd., John, Toronto	15,018
Total	302,686

60. lb. High Explosive

Can. Allis-Chalmers Ltd., Toronto	22,493
Can. Locomotive, Kingston	34,974
Can. Malleable Iron Works, Owen Sound, Ont.	64,919
Can. Westinghouse, Hamilton	35,010
Chapman Eng. & Mfg. Co., Dundas, Ont.	18,408
Coghlin & Co., B. J., Montreal	43,977
Dominion Bridge Co.	11,695
Doty Engine Co.	9,962
Eastern Machine Co., Montreal	44,963
Jenckes Machine Co., Sherbrooke, Q.	10,641
Leonard & Sons, E., London, Ont.	146,597
Long Mfg. Co., E., Orillia, Ont.	207,739
Lyall & Sons Construction Co., P., Montreal	88,924
Montreal Amm. Co., Montreal	50,042
Munitions & Machinery Co., Montreal	112,588
McGregor & McIntyre Co., Toronto	51,303
McKinnon-Dash Co., St. Catharines	61,392
Napanee Iron Works, Napanee, Ont.	26,445
N.S. Steel & Coal Co., New Glasgow, N.S.	10,000
Sawyer-Massey Co., Hamilton, Ont.	42,489
Steel Co. of Canada, Stratford, Ont.	10,000
Total	1,104,288

4.5 Howitzers

*Alberta Fdry. & Machine Co., Medicine Hat	108,564
*Albion Machine Co., New Glasgow, N.S.	243,629
Acton Foundry Co., Acton, Ont.	130,180
*Bell & Sons, B., St. George, Ont.	8,550
*Branden Shell Co., Toronto	31,255
*Buckeye Foundry Co., Calgary, Alta.	2,797
*Burlington Steel Co., Hamilton	14,558
*Can. Stove & Foundry Co., St. Laurent, P.Q.	318,286
*Can. Allis-Chalmers Co., Toronto	190,687
*Can. Car & Foundry Co., Montreal	162,201
*Can. Locomotive Works, Kingston, Ont.	124,045
Can. Malleable Iron Co., Owen Sound, Ont.	73,873
*Can. Steel Foundry Co., Montreal	369,000
*Can. Westinghouse Co., Hamilton	122,090
*Chapman Eng. Mfg. Co., Dundas, Ont.	23.318
*Cobourg Shell Co., Cobourg, Ont.	134,669
Coghlin & Co., B. J., Montreal, P.Q.	9,425
*Collingwood Shipbldg. Co., Collingwood, Ont.	29,126
*Copp Stove Co., Fort William, Ont.	214,203
*Cummings & Sons, J. W., New Glasgow, N.S.	201,887
*Darling Bros., Ltd., Montreal	181,639
*Dominion Bridge Co., Montreal	81,164
*Dom. Copper Products Co., Montreal	938,741
*Dominion Steel Co.	48,668
*Eastern Steel Co., New Glasgow, N.S.	108,739
*Fawcett & Co., Chas., Sackville, N.B.	174,973
Frost & Wood Co., Smith's Falls	69,076
*Gen. Railway & Signal Co., Montreal	91,869
*Goold, Shapley & Muir Co., Brantford, Ont.	126,952
*Hamilton Co., Wm., Peterborough, Ont.	57,274
*Holden-Morgan Co., Toronto	70,043
*Hepburn Bros., Ltd., Montreal	311,542
Hunter Bridge & Boiler Co., Kincardine, Ont.	38.769
*Inglis Co., John, Toronto	106,707
*Robb Engineering Co., Amherst, N.S.	239,800
*Jenckes Machine Co., Sherbrooke, P.Q.	161,241
*Jenkins Bros., Ltd., Montreal	84.011
Ker & Goodwin Co., Brantford, Ont.	271,006
*Leonard & Sons, E., London, Ont.	149.240
Lauzon Engineering Co., Levis, P.Q.	262,581
*Long Mfg. Co., E., Orillia, Ont.	43.009
*Lyall & Sons Construction Co., P., Montreal	438.577
*Martin Pump & Machine Co., Toronto	160,089
*Maritime Foundry & Mach. Co., Chatham, N.B.	59,459
Marsh Engineering Works, Belleville, Ont.	127,979
*Matheson & Co., I., New Glasgow, N.S.	13,649
*Manitoba Engines, Ltd., Brandon, Man.	30,824
*Man. Bridge & Iron Co., Winnipeg	122,150
*McAvity & Sons, T., St. John, N.B.	150,924
*McDonald Thresher Co., Stratford, Ont.	103,683
McDougall Caledonian Iron Works, Montreal	82.711
*McFarlane Engineering Co., Paris, Ont.	113,872
*McGregor & McIntyre, Ltd., Toronto	25,973
Mechanical Engineering Co., Three Rivers, P.Q.	32,454
*Medicine Hat Pump & Brass Co., Medicine Hat, Alta.	76,532
*Montreal Locomotive Works, Montreal	489,519
*Motor Trucks, Ltd., Brantford, Ont.	256,893
*Munitions & Machinery Co., Montreal	91,177
*Napanee Iron Works, Napanee, Ont.	37,940
National Hardware Co., Orillia, Ont.	91,777
*National Machinery & Supply Co., Hamilton	11,568
*Newfoundland Shell Co., St. John's, Nfld.	52,711
*New Barrell-Johnston Co., Yarmouth, N.S.	61,809
*Norwood Engineering Co., Cowansville, P.Q.	99,571
*Northern Foundry & Machine Co., Sault Ste. Marie, Ont.	82,678
*N.S. Steel & Coal Co., New Glasgow, N.S.	99,322

O'Connors, Ltd., Montreal	42,269
*Ormsby Co., A. B., Toronto	244,698
*Otis-Fensom Elevator Co., Toronto	156,222
*Phoenix Foundry & Loco. Co., St. John, N.B.	29,094
*Polson Iron Works, Toronto	19,549
*Port Hope Supply Co.	4,121
*Prescott Emery Wheel Co., Prescott, Ont.	57,676
*Public Enterprise Co., Levis, P.Q.	70,816
*Pioneer Tractor Co., Ltd., Calgary, Alta.	-4,660
*Quebec Engineering Co., Quebec	105,598
*Record Foundry & Machine Co., Moncton, N.B.	206,424
*Robertson Mfg. Co., P. L., Milton, Ont.	38,166
*Roelofson Machine & Tool Co., Galt	52,193
*Saskatchewan Bridge & Iron Co., Moose Jaw, Sask.	89,579
*Sawyer-Massey Co., Hamilton	15,825
*Seaman-Kent Co., Hamilton	35,929
Sherbrooke Iron Works, Sherbrooke, P.Q.	399,008
Sorel Mechanical Shops, Sorel, P.Q.	154,255
*Smith Foundry Co., Fredericton, N.B.	138,581
*Spartan Machine Co., Montreal	352,816
*St. Thomas Construction Co., St. Thomas, Ont.	122,689
*St. Lawrence Iron Foundry, Montreal	56,015
*Stratford Mill Bldg. Co., Stratford, Ont.	61,249
*Steel & Radiation, Ltd., Toronto	207,078
*Steel Co. of Canada, Ltd., Brantford, Ont.	190,384
*Starr Mfg. Co., Dartmouth, N.S.	23,928
*Toronto Structural Steel Co., Toronto	130,180
*Toronto Type Foundry Co., Toronto	43,616
*Truro Steel Co., Truro, N.S.	134,869
*Vancouver Engineering Co., Vancouver, B.C.	7,607
*Victoria Machinery Depot, Victoria, B.C.	4,881
*Vulcan Iron Works, New Westminster, B.C.	5,717
*Vulcan Iron Works, Winnipeg	75,677
*Waterous Engine Works, Brantford, Ont.	186,258
*Western Machinery Co., Port Arthur, Ont.	10,339
*Western Shell & Box Co., Edmonton, Alta.	49,759
*Wilford & Co., F. R., Lindsay, Ont.	100,819
*Wilson & Co., J. C., Belleville, Ont.	78,751

*Complete figures.

18-lb. Shrapnel

Albion Machine Co., New Glasgow, N.S.	13,054
Banfield & Sons, Toronto	721,817
Beatty & Sons, M., Welland	98,427
Bertram & Sons, J., Dundas	520.228
Brown, Boggs Co., Hamilton	172,000
Canada Beds, Ltd., Chesley, Ont.	128.189
Can. Allis-Chalmers Co.	899,851
Can. Bridge Co., Walkerville	189,811
Can. Car & Foundry Co., Montreal	299,899
Can. Crocker-Wheeler Co., St. Catharines	530,501
Can. Fairbanks-Morse Co., Toronto	3,030.313
Can. Ingersoll-Rand Co., Sherbrooke, P.Q.	1,969,326
Can. Locomotive Co., Kingston	202,132
C.P.R., Montreal	920,190
Can. Vickers, Ltd., Montreal	513,225
Can. Westinghouse Co., Hamilton	793,414
*Chapman Double Ball Bearing Co., Toronto	894,936
Cluff Bros., Toronto	37,418
*Cobourg Steel Co., Cobourg	3,625
Collingwood Shipbuilding Co., Collingwood	152,238
*Cummings & Sons, J. W., New Glasgow, N.S.	12,046
Dominion Bridge Co., Montreal	3,743
Dominion Steel Foundries, Hamilton	1,316,430
*Drolet & Co., F. X., Quebec	70,259
Eastern Steel Co., New Glasgow, N.S.	269,202
Electric Steel & Metals Co., Welland	18,761
*Fawcett & Co., Chas., Sackville, N.B.	2,874
Fisher Motor Co., Orillia, Ont.	159,431
*Fittings, Ltd., Oshawa, Ont.	389,911
*Gen. Car & Machinery Co., Montmagny Stn., P.Q.	751,602
Goldie & McCulloch Co., Galt, Ont.	842,000
*Loughead Machine Co., Sarnia	175,626
*London Mfg. & Machine Co., London	692.067
Lymburner, Ltd., Montreal	774,610
*Lymco Corporation, Montreal	3,895
Massey-Harris Co., Ltd., Toronto	746,930
*Metal Drawing Co., St. Catharines	631,769
Montreal Locomotive Works, Montreal	452,674
*Mueller Mfg. Co., Sarnia, Ont.	315,137
National Machine & Motor Co., New Glasgow, N.S.	197,777
*National Machinery & Supply Co., Hamilton	293,200
*National Mfg. Co., Ottawa and Brockville	1,179,373
National Steel Car Co., Hamilton	469,562
*Northern Electric Co., Montreal	523,649
*Norton Co., A. O., Coaticook, P.Q.	108,641
Grand Trunk Railway, Montreal	445,094
Grand Trunk Railway, Stratford	441,681
*Hamilton Gear & Machine Co., Toronto	615,458
*Ingersoll Machine Co., Ingersoll, Ont.	709,390
International Engineering Co., Amherst, N.S.	60,343
Inglis Co., John, Toronto	437,335
*Jardine & Co., A. B., Hespeler, Ont.	233,123
Jenckes Machine Co., Sherbrooke	124,077
*N.S. Steel & Coal Co., New Glasgow, N.S.	289,270
*Otis-Fensom Elevator Co., Toronto	270,616
*Estate of Jas. Fleming, St. John, N.B.	307,132
*Pink Mfg. Co., Thos., (burned out), Pembroke, Ont.	452,758
*Polson Iron Works, Toronto	375,003
*Record Foundry & Machine Co., Moncton, N.B.	19,202
*Renfrew Machinery Co., Renfrew, Ont.	674,040
*Renfrew Manufacturing Co.	11,395
*Roelofson Machine & Tool Co., Toronto	3,000
Sawyer-Massey Co., Hamilton	81,250
*Sheldons, Ltd., Galt, Ont.	641,538
Steel Co. of Canada, Brantford, Ont.	616,509
*Steel of Canada, Montreal	274,704
*Steel & Radiation, Ltd., Toronto	845,665
*St. Thomas Construction Co., St. Thomas, Ont.	6,910
*Truro Steel Co., Truro, N.S.	21,828
Toronto Laundry & Mach. Co., Toronto	854,197
Western Dry Dock & Shipbuilding Co.	35,014
Zenith Machine Co., Montreal	300,649

*Figures not complete.

NOTE—This is supplementary to the list above, and gives further production available to date.

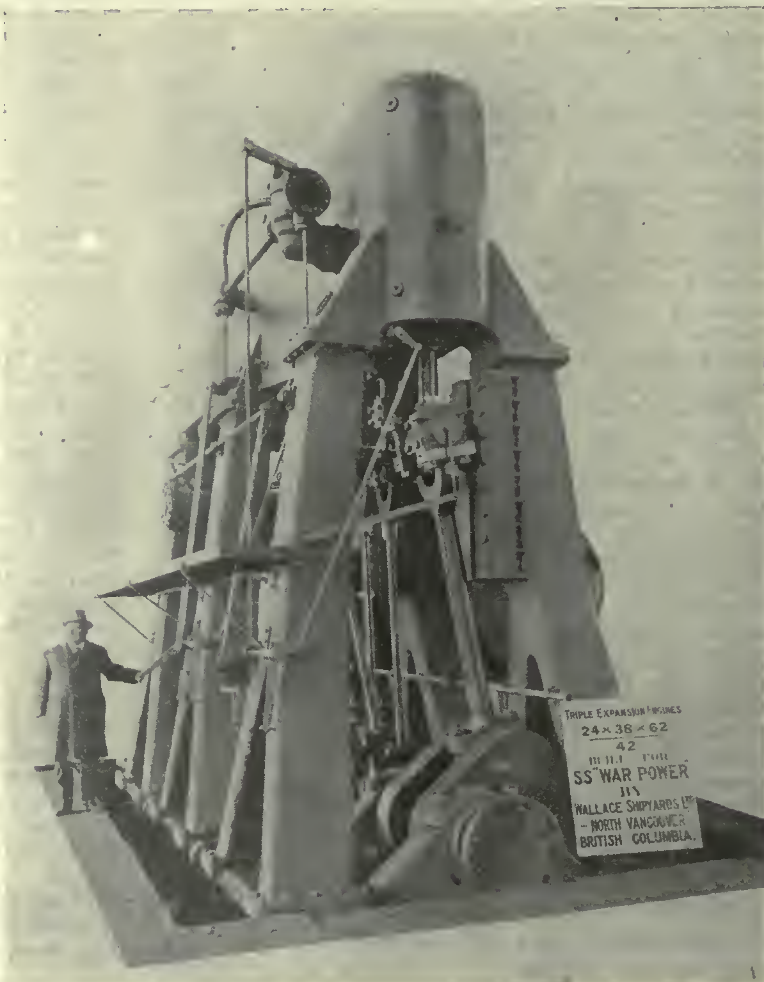
18-lb. Shrapnel

Gen. Car and Machinery Co.	42,445
Drolet, F. X.	3,167
Lymco Corporation	3,895
Northern Electric	31,740
Norton, Limited, A. O.	9,012
Chapman Double Ball Bearing Co.	25,722
Fittings, Limited	12,190
Hamilton Gear & Machinery Co.	27,845
Ingersoll Machine Co.	25,651
Metal Drawing Co.	40,351
National Machinery and Supplies	8,118
Otis-Fensom Elevator Co.	16,860
Steel & Radiation	35,048
Toronto Laundry Machine Co.	21.892
Cobourg Steel Co.	6,505
National Manufacturing Co.	22,195
Renfrew Machinery Co.	41,950
Renfrew Manufacturing Co.	27,015
Jardine & Co., A. B.	2,908
London Mfg. and Machine Co.	31,884
Loughead Machine Co.	9,995
Mueller Manufacturing Co.	18,156
Roelofson Machine & Tool Co.	6,209
Sheldons, Limited	29,123
St. Thomas Construction Co.	13,300
Albion Machine Co.	13,832
Cummings & Son, Ltd., J. W.	16,170
Fleming, Jas., Estate of	6,114
Fawcett, Limited, Charles	8,506
N.S. Steel & Coal Co.	10,453
Record Foundry & Machine Co.	20,562
Smith Foundry Co.	8,056
Truro Steel Co.	10,423

British Columbia's Part in Ship Programme

The Year Has Seen a Tremendous Revival of Industry in the Pacific Coast Province—What the Future Has in Store.

By A. F. MENZIES



DURING the past twelve months or so, British Columbia has, so to speak, come into her own as regards shipbuilding. The extensive program undertaken by the Imperial Munitions Board Wooden Shipbuilding Department has been completed, resulting in the addition of 27 wooden steamers of a total D. W. capacity of over 75,000 tons. Of steel boats 40,000 tons D.W. have been passed into service.

The Imperial Munitions Board wooden shipbuilding programme was carried out by yards which built the hulls only, the Imperial Munitions Board being responsible for the supplying and the installation of machinery, etc. The 27 hulls were divided up between the following concerns: Wm. Lyall Shipbuilding Co., Ltd., 6; Western Canada Shipyards Ltd., 6; Western-Genoa Co., Ltd., 4; The Foundation Co. of Victoria, Ltd., 5; New Westminster Construction and Engineering Co., Ltd, 4; Coquitlam Shipbuilding Co., Ltd., 2.

The boats are of the well decked type with the poop extended to the bridge deck. They are 250 feet long B.P., by 42 ft. x 6-in. mld. beam, by 25 ft. mld. depth. The carrying capacity on a draught of 21 ft .is about 2,800 tons.

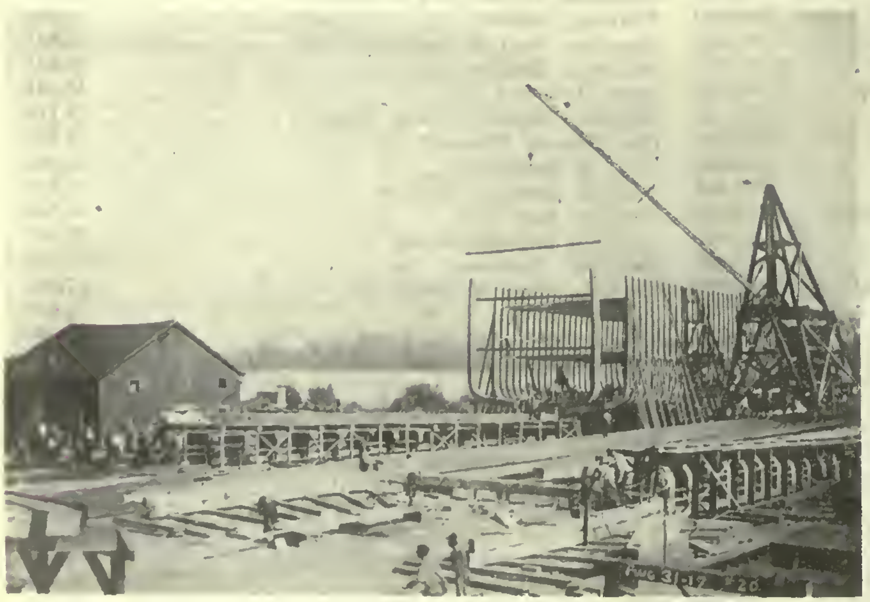


FIG. 1—WOODEN STEAMER IN FRAME

The hull is divided into several compartments by watertight bulkheads, which will materially assist in keeping the vessel afloat should it become damaged. About one and a half million feet of lumber was used in each boat, while for caulking over 350 bales of oakum were required.

The following brief description of the more important timbers will give an idea of the sizes of lumber used. Fig. 1 shows one of these boats being framed.

The keel is in four pieces all 20 x 24 in and from 54 to 76 ft. in length, the various lengths being joined together by scarps are carefully shifted in order also 20 x 24 in. and the sister keelson 24-ins. square. These sticks are in as long lengths as is practicable and the scarphs are carefully shifted in order to maintain the maximum possible strength throughout.

On the top of the wooden keelson there is a steel box girder keelson consisting of top and bottom plates 25 and 40 ins. respectively by ¾-in., web plates

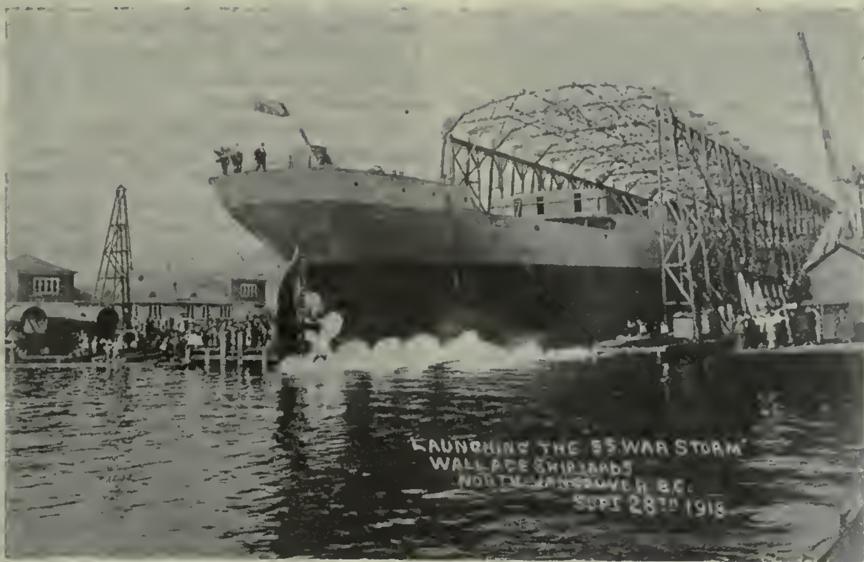


FIG. 2—LAUNCH OF "WAR STORM"

24-in. x ½-in., all secured by 6-in. x ½-in. angles.

The frames are doubled 12-in. sided and are tapered from 24-in. at the keel to 11-in. at the main deck. They are spaced 3 ft. centres. There are three garboard strakes, the first being 18-in. x 10-in. The planking is all 6-in.

The ceiling on the bottom is 12 x 10 in., on the turn of the bilge 14 x 14 in., and 12-in. x 10-in. and 8-in. on the sides. In order to avoid local weak spots the butts of the planking and ceiling are well shifted.

On the line of the hold beams there are two stringers each 14-in. x 16-in. and one clamp 14-in. square. The main deck stringer is composed of three strakes of 14in. x 14-in. These sticks are also in long lengths.

The main deck beams are 14-in. by 14-in., spaced 3 ft. centres, that is, one on every frame. The main deck is of 4½-in. x 4½-in. edge grain. Edge grain timber is used for decking on account of its wearing qualities, also there is no tendency to sliver. The narrow planking is preferable on account of the lessened amount of contraction and expansion to be taken care of at each seam. The upper deck is 3½-in. x 3½-in., also edge grain.

The propeller post is 30-in. moulded by 24-in. sided, being swelled to 32-in. at the shaft line. The shaft log, another large piece, is composed of two pieces of 36-in. x 18-in. To bracket the various parts together a large number of natural knees are used.

There are three cargo holds and one deep tank for water ballast, the holds and tanks being separated by water-tight bulkheads. The cargo holds are served by six steam winches operating through 5-ton derricks.

Some of the propelling machinery was procured in the East, the remainder being built by the Wallace Shipyards Ltd., of North Vancouver.

The engines are triple expansion, having cylinders 20-in. x 33-in. and 54-in. in diameter, with a common stroke of 40-in. and operate at about 70 R. P. M., developing 1,000 I.H.P.

The boilers are of the Howden water tube type, fitted with Howden's system of heated forced draught. About half the total number of boilers required were built by the Victoria Machinery Depot, of Victoria, B.C.

All the deck auxiliaries are products of British Columbia, the winches and windlasses being built by the Terminal City Iron Works, The North Shore Iron Works and Hutchison Bros. The steering gears, horizontal, double-geared machines, were built by the Schaake Co., Ltd., and Yarrows Ltd.

As previously mentioned, the shipbuilders were not responsible for the installation of machinery. This work was carried out by the Imperial Munitions Board at their own plant at Ogden Point, Victoria. The delivery of hulls, was, however more than fast enough to load this plant up, and to avoid delay several ships had their machinery installed at private yards.

On trials, with bunkers aboard, these vessels have made a speed of 11 knots per hour.

Three steel boats have been placed in commission by the Wallace Shipyards. These boats were built to the order of the Imperial Munitions Board and are 300 ft. long B.P. by 45 ft. mld. beam by 27 ft. mld. depth and carry 4,700 tons on a draught of 22 ft., 7 in. Fig. 2 shows the War Storm being launched in September.

With the exception of auxiliary apparatus in the engine room these boats are entirely British Columbia products. The main engines were built in the yards machine shop. The boilers were built by the Vulcan Iron Works at their plant on Granville Island. Deck winches and windlasses were built by the North Shore Iron Works, of N. Vancouver.

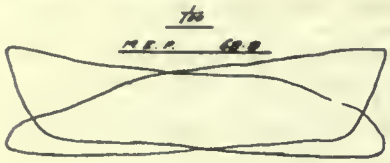
The vessels are of the well decked type with the machinery located amidships. Officers' quarters are on the bridge deck and crews' quarters in the poop. Extra large hatches are provided for convenience in handling cargo.

The engines are triple expansion with cylinders 24-in., 38-in. and 62-in. in diameter with a common stroke of 42-in. They are fitted with piston valves on the H.P. and I.P. cylinders and a double-ported, balanced slide valve on the L.P. The title cut shows a set of these engines in shop ready to be dismantled and installed in the boat. It will be seen that bridge columns are provided both back and front, giving a remarkably rigid job.

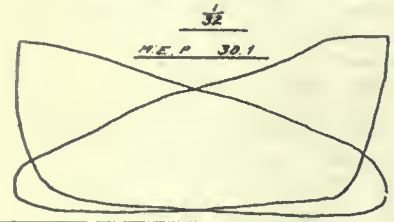
There are no pumps on the main engines, the idea being that the jobs could be turned out and installed quicker if these items were made independent. The circulating pump was of the centrifugal type, supplied by the Morris Machine Works. The condenser, made by the Wallace Shipyards, was built with a steel plate shell, rolled brass tube

FIG. 4—VULCAN IRON WORKS BOILER SHOP

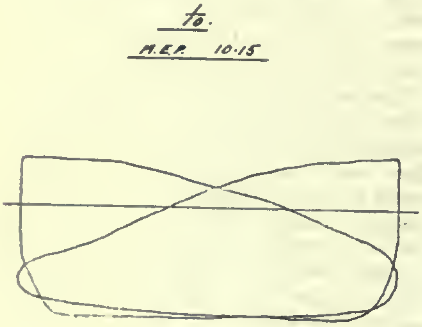
plates and cast iron ends. It was supported on the back of the I.P. and L.P. columns by steel plate stools. The air and feed pumps were made by Dean Bros., of Indianapolis, and were supplied



HIGH PRESSURE CARD



INTERMEDIATE CARD



LOW RESSURE CARD

SHIP

Draught For'd. 8' 2"
Draught Apt. 14' 6"
Draught, Mean, 11' 4"
Displacement, 3,090 tons.
Length B.P., 300 feet.
Beam Mld. 46 feet.
Depth Mld. 27 feet.

ENGINES $\dfrac{24'' \times 38'' \times 62''}{42''}$

Pressures

Boiler, 160 lbs. per sq. inch.
I.P. Receiver, 58 lbs. per sq. inch.
L.P. Receiver, 4.5 lbs. per sq. inch.
Condenser, 25.5 inches vac.

Powers

H.P.	553 I.P.H.
I.P.	606 I.H.P.
L.P.	546 I.P.H.
Total	1,705

Propeller 15' 0" dia., 15' 6" pitch.
Revolutions per min., 84.
Speed, 12 knots per hour.

FIG. 5—TRIAL TRIP DATA

by F. Darling & Co., of Vancouver. These pumps are of the simplex type, the main feed pump having a long stroke and being large enough to handle the work at very slow speed. The other auxiliary pumps were of the duplex type and were also supplied by F. Darling & Co.

Steam was supplied by two Scotch marine boilers 15 ft., 6-in. diameter by 11 ft., 3-in. long, working at 180 pounds per square inch. The total heating surface provided was 5,108, the grate area being 132 square feet, giving a ratio of 1 to 38.7.

The boilers were built by the Vulcan Iron Works. Fig. 4, showing one side of the main bay of their shop, shows the boilers for the War Storm among a number of others for J. Coughlan & Sons' ships.

On trial these boats have done up to 12 knots per hour, with bunkers aboard. Fig. 5 shows the trial trip data obtained on the War Power on June 27, 1918.

The machine shops of the Wallace Shipyards have been more than busy, for, besides engines for their own boats and repair jobs, they have turned out three sets of engines for the Imperial Munitions Board wooden ships. Two of these sets were also installed and the ships completed and delivered under steam at Victoria.

These engines differ from those in the steel boats in that the pumps are driven from the I.P. crosshead by single plate levers, and the condenser shell is of cast iron and is built-in.

The Wallace Foundry has furnished the castings for all this machinery as well as doing a lot of outside work, notably a contract, for 27 cast iron propellers for the Imperial Munitions Board.

FIG. 6—MOLD LOFT AT WALLACE SHIPYARD

An interesting job carried out by the yard was the lengthening of a couple of steel tug boats, the Point Grey and the Point Ellice. The former was built by the Wallace Shipyards and the latter by McDougall & Jenkins, now the North Shore Iron Works. They belong to the Department of Public Works and were employed as dredge tenders. On the dredging work being closed down they were taken over by the Imperial Munitions Board, Aeronautical Department, for towing spruce logs. As both the boats were built for harbor service their bunker capacity was not large enough for log towing, which would require the boats to be away from their base for about three weeks at a time They were both oil burners and it was decided to lengthen them and build in additional oil tanks.

The boats were both hauled out on the large ways at the same time, the ends separated and the new portion built in. The boilers were then shifted aft to the same relative position in relation to the engines which they occupied before, and a new oil-tight bulkhead built forward of them. The space thus provided between the old and the new bulkheads gave ample capacity for the fuel oil.

As the boats were short, 100 ft. and 91 ft., 6 in. respectively, and very fully powered, some interesting calculations were entailed to ensure, that when lengthened, they would trim properly.

The Wallace Shipyards plant has recently undergone extensive alteration and extension, a new plate shed and mold loft being constructed. Fig. 6 shows the latter, which is 186 feet long by 80 feet broad. It is located above the plate shed, which is equipped with a mono-rail system for handling plates, etc. Three building berths have been provided, capable of taking vessels up to 400 feet long.

The system of handling material from the plate shed to the building berths is by standard gauge railroad running between the berths. At each end of the berths a tower is located under which the tracks run. The towers are 48 feet high and each tower carried a pair of derricks equipped with 80-ft. booms. As the towers are high enough to permit the boom to swing across the deck of a ship, it appears to be an excellent system.

The work of extension has been carried out by Messrs. Hodgson and King, contractors, of Vancouver.

The Wallace Shipyards have at present under construction two steel boats of 4,300 tons D.W. and two of 5,100 tons D.W. for the Dominion Government.

The former are 320 ft. long B.P., by 44 ft. mld. beam, by 25 ft. mld. depth, and are designed to carry their deadweight on a mean draught of 21 ft., 2 in. A 6 hour loaded trial is called for and a speed of 11½ knots is to be maintained.

Accommodation is provided for 34 officers and men, the former being berthed in deck-houses on the bridge deck amidships and the latter aft.

11 steam winches and an anchor windlass are provided for handling cargo and anchors. These auxiliaries are being built by the North Shore Iron Works.

The propelling machinery consists of a set of triple expansion engines having cylinders 25 in., 41 in. and 67 in. with a common stroke of 45 in., the air, feed and bilge pumps being driven from the L.P. crosshead.

Steam is supplied by two single ended Scotch marine boilers 15 ft., 6 in. diameter by 11 ft., 6 in. long, working at 180 pounds per square-inch. The boilers are operated under heated forced draught, the well known Howden's system of closed ashpits being used.

The 5,100-ton steamers which this firm is building for the Dominion are of the type "C" of the standard series. They are 331 ft. B.P. by 46 ft., 6-in. mld. beam by 25 ft., 6-in. mld. depth, and have a mean draught of 21 ft., 8 in.

A speed of 12 knots loaded is specified. The main engines being 25 in., 41 in., and 68 in. by 45 in., with air, feed and bilge pumps attached, the circulating pumps being of the centrifugal type driven by a small independent engine. There are three boilers 14 ft. diameter by 11 ft., 6 in. long, working at 180 pounds per square-inch. The boilers are operated under forced draught, approximately 7,275 square-

FIG. 7—HULL OF THE MARGARET HANEY, AUXILIARY POWER SCHOONER, UNDER CONSTRUCTION

feet of heating surface being provided. The arrangement of the boilers in the ship shows the three abreast, consequently there are no side bunkers in either the engine room or stokehold. Permanent bunkers are provided under the bridge deck and a large cross bunker forward of the stokehold. On short passages the latter could be used for cargo.

The boilers for these boats as well as those already turned out will be built by the Vulcan Iron Works at their plant on Granville Island, Vancouver. The Vulcan Iron Works, have since the destruction by fire of the boiler shop at the shipyard of J. J. Coughlan & Sons, supplied that firm with boilers for their vessels. This boiler shop is fully modern in every respect, having been built within the last few years and recently extended.

The equipment consists of a three ram flanging machine, a 12 ft. plate bender, and a large riveter, all operated by hydraulic power. Drilling holes, the usual bugbear of the boiler shop is very well taken care of, a two-head, movable column drilling machine being provided for shell drilling and several radial drills being available for combustion chamber work. One of the recent additions to the plant is the machine shop in which all tools are made, stays threaded and work of a like nature carried out.

The plate furnace, for annealing the large end plates after flanging is rather

VIEW OF J. COUGHLAN & SONS' SHIPBUILDING PLANT, VANCOUVER, B.C., SHOWING FROM LEFT TO RIGHT:—SS. WAR CAMP, SS. WAR CHARGER, SS. WAR CHIEF

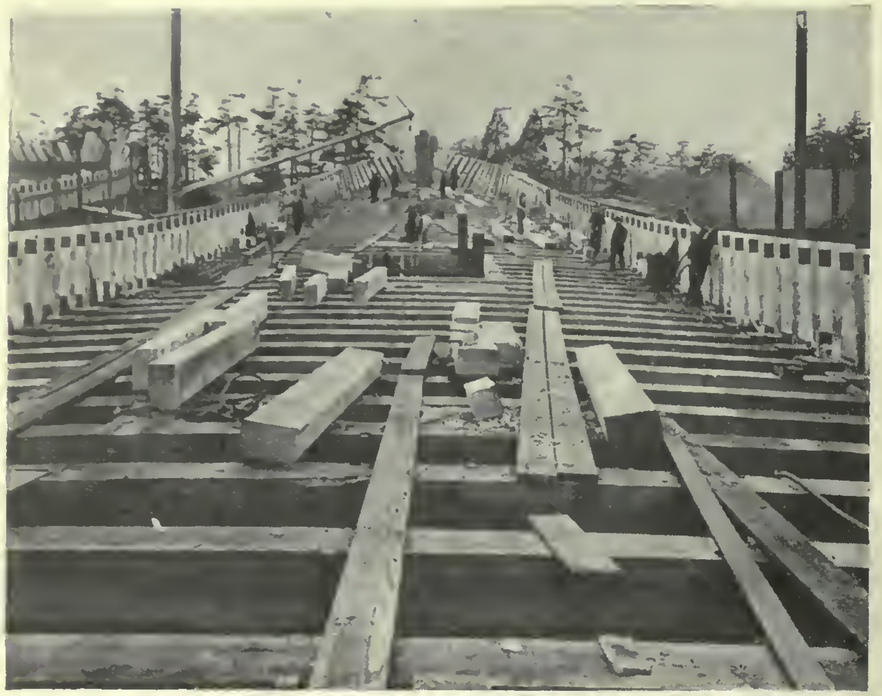


FIG. 8—DECK VIEW OF AUXILIARY SCHOONER

interesting in that the fuel used is slabs, which are obtained as refuse from the local sawmills. The rivet heating furnace at the hydraulic riveter uses the same fuel. Both have given every satisfaction. They were installed by Mr. T. A. Thomas, of Nanaimo, B. C.

Besides the large marine boilers, the Vulcan Iron Works have handled a lot of other work, among which was the finishing of the rudders for the Imperial Munitions Board wooden ships, the hydraulic riveter being used for riveting the plate to the arms. A number of smoke stacks and uptakes were also built for these boats. Two large locomotive boilers were built for the Canadian Collieries (Dunsmuir), Ltd., who operate an extensive coal field on Vancouver Island. These boilers were installed in existing locomotives, the boilers of which were worn out. A number of large digesters were also built for a local pulp mill.

Fig. 4 shows one side of the main bay of this plant and the string of boilers 14 ft., 9 in., and 15 ft., 6 in. in diameter proves that the manufacture of this type of kettle is well established in British Columbia.

The Wm. Lyall Shipbuilding Co., Ltd., of N. Vancouver have, since the completion of their contract with the Imperial Munitions Board, been working for their own account on a programme of six auxiliary powered schooners.

These boats are five-masted topsail schooners, and, with the exception of the addition of topsails and some slight alteration to the sheer line and deck houses are the same as the first boats built in this yard when it was established as the Wallace Shipyards Plant No. 2.

The schooners are 225 ft. long on the keel by 44 ft., 6 in. extreme beam by 20 ft., 9 in. mld. depth. They will carry about 2,500 tons D.W.

Three of these boats are fitted with twin Atlas Diesel engines of about 175 B.H.P. each, the remaining three with Fairbanks-Morse semi-Diesel engines of 200 B., H. P. each.

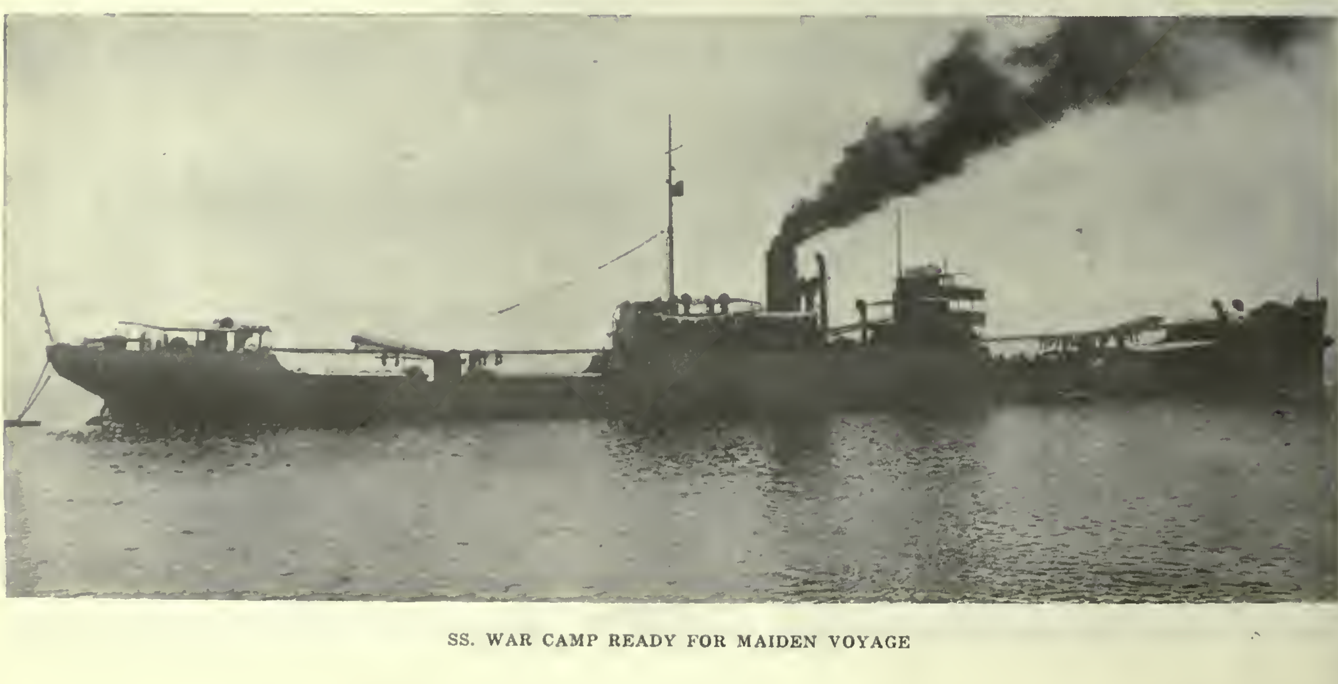
At the time of writing three of the schooners have been launched and were in various stages of completion. The others will probably all be launched by the end of the year.

This yard is equipped with six building berths and as they are vacated by the schooners, keels are being laid for a contract for eight steamers for French interests.

The dimensions of these boats will be 195 ft. B.P., 204 ft., 6 in. over all by 39 ft., 8 in. mld. beam by 17 ft. depth of hold and on a mean draught of 16 ft. will carry about 1,500 tons D.W.

Two masts are provided and are fitted with two derricks each for cargo handling. The deck auxiliaries comprise six cargo winches by M. Beatty & Sons, an anchor windlass by the Terminal City Iron Works, of Vancouver, and a steam steering gear by the Schaake Co., Ltd. The steering gears are of the same type which this firm supplied to the Imperial Munitions Board for their wooden ships.

The propelling machinery consists of two sets of compound engines having cylinders 12 in. and 24 in. with a common stroke of 16 in. The engines are being supplied by the Sorel Mechanical Shops, Sorel, Quebec. They are arranged back to back in the ships with the operating gear led to the space between them. At their rated speed an



SS. WAR CAMP READY FOR MAIDEN VOYAGE

WOODEN SCHOONER ALICE BEAUCLERC ON THE WAYS

output of 550 I.H.P. will be obtained. There are no pumps attached to the engines, all auxiliaries being independent.

Steam is supplied by a Scott water tube boiler having 2,012 square-feet of heating surface, 56 square-feet of grate area, giving a ratio of about 1 to 36. Steam for cargo handling is supplied by a smaller boiler of the same type operating at 125 pounds working pressure.

Twelve more ships of a similar description, and for the same owners are being built in British Columbia. They are apportioned as follows: Western Canada Shipyards, 5; New Westminster Construction & Engineering Co., Ltd., 5; Pacific Construction Co., Coquitlam, 2.

At one time prominent in the steel construction business, Messrs. J. J Coughlan & Sons have, for the past year or so, given their entire attention to their shipyard on False Creek. This yard is the largest shipbuilding plant on the coast. It is equipped with four building berths which are all completely covered in. The berths are each provided with three sets of runways for travelling cranes. The covered berths make efficient work possible in all conditions of weather. Although British Columbia does not suffer from intense cold during the winter, there is enough rain to render a covered building berth a very good investment. The plate shed with the mold loft above is located west of the berths and material is handled from the shed to under the travelling cranes by trucks running on standard gauge track.

While this firm does not build their own machinery a good-sized machine shop is provided. In the machine shop the hundreds of small fittings are made, as well as the propellers, stern tubes, etc.

As originally laid out a boiler shop was included in the yard and in it the boilers for the Alaska, the first boat turned out, were built. The boiler shop was, unfortunately, destroyed by fire and the heavy hydraulic machinery, so necessary for the construction of large marine boilers, was a total loss. As it was practically impossible to replace the machinery it was decided to hand this part of the work over to the Vulcan Iron Works.

J. J. Coughlan & Sons have three boats in commission, two in the water being fitted out, one ready for launching and four in various stages of construction. Thesee boats are 427 ft. long B.P., 54 ft. mld., beam 29 ft., 9 in. mld depth and carry 8,800 tons D.W. on a draught of 25 ft., 2 in. When complete they make a very fine looking boat and are fitted up and finished in first-class shape. As a matter of fact it has

SS. WAR CHARGER AT NO. 2 FITTING OUT BERTH been remarked by people who are able to judge and who have seen the work in both ends of the country, that the workmanship turned out in British Columbia is superior to that of the East, both in regard to hull and engine and boiler work.

The engineer's accommodation is located on the after end of the bridge deck alongside the engine room casing. The captain's and mate's quarters being at the forward end, in the saloon.

The deck auxiliaries comprise ten cargo and one warping winches, which are being supplied by the North Shore Iron Works, an anchor windlass and a steam steering gear. The latter is driven by a double cylinder engine and is located in the poop, being operated under telemotor control from the bridge.

The ships are all driven by geared turbines, four sets being supplied by the Kerr Turbine Co., of Wellsville, and are of the impulse type. The other six are of the Parsons type. Both types are equipped with double reduction gearing, the Parsons turbines being in two units and have astern elements in each. At rated speed and pressure the turbines give approximately 2,650 S. H. P. The propellers are 14 ft. diameter and turn up 100 revs. per minute, giving a loaded speed of 10½ knots per hour.

Steam is supplied at 190 pounds per square-inch by three boilers 14 ft., 9 in. diameter by 10 ft., 6 in. long. The boilers are operated under forced draught and are equipped with Foster superheaters, a superheat of 50 deg. F. being maintained. The forced draught outfits are supplied by the Jas. Howden Co., of Glasgow, Scotland. The fans are provided with double engines As these engines have to run at a fairly high speed for long periods, the provision of two engines enables them to be overhauled at sea. The change over can be effected in a very few minutes.

Crompton's ash hoists are employed for the disposal of ashes. These hoists raise and dump the ashes automatically through a chute leading to the ship's side and form one of the most convenient and cleanly methods of getting rid of ashes.

Single collar thrusts of the Kingsbury type are employed on the shafting, the thrust bearing being made by the Canadian Westinghouse Co.

The main condensers, containing 4,000 square-feet of cooling surface are supplied by the Wheeler Condenser & Engineering Co. They are equipped with radio-jet air extractors, circulating water being handled by a 14-in. Morris Machine Works centrifugal pump.

On completion of their present work, Messrs. J. J. Coughlan & Sons will be engaged on Dominion Government work, having secured contracts for the construction of vessels of 8,100 tons D.W.

These boats are the type "B" of the standard series. They are 400 ft. long B.P. by 52 ft. mld. beam by 31 ft. mld. depth, and carry their deadweight on a mean draught of 25 ft., 1 in. They will have a speed of 11¾ knots per hour.

The hull is divided by six water-tight bulkheads and the usual double bottom is provided, the double bottom under the machinery space having a water-tight centre-line. Accommodation is provided for a complement of 47 officers and men. Rather more than the usual care has been bestowed on the accommodation, and there is no doubt that these boats, as well as those which are being built by the Wallace Shipyards for the Dominion Government, will be a credit to Canada. The steam steering gear is located in the poop and is of the guided segment type, controlled by telemotor from the bridge. Cargo handling is provided for by ten 7-in. by 12-in. double cylinder single drum winches, the winch on the bridge deck and that on the poop deck having extended shafts carrying warping barrels. A quick warping type anchor windlass is located on the forecastle deck.

It might be mentioned that in going over modern ship specification the absence of reference to copper pipe is noticed. It used to be considered that copper was the only suitable material for steam and feed pipes. In all the boats built in British Columbia mild steel pipe has been used for these purposes, and none of it has given any trouble.

The propelling machinery is a triple expansion engine having cylinders 27 in., 44-in., and 73-in., with a common stroke of 48-in. and is rated at 3,000 I. H. P. The H. P. and I. P. cylinders are provided with piston valves and the L. P. with a double-ported slide valve.

A circular steel plate condenser, built on the contraflo principle, is provided containing 3,000 square-feet of cooling surface.

LAUNCH OF THE HELEN LYALL

The air, feed and bilge pumps are attached to the engine. The air pump being 24-in. by 24-in. and of the Edwards type. The feed and bilge pumps are each 4-in. by 24-in.

Steam is supplied by three single ended marine boilers 15 ft., 6-in. diameter by 11 ft., 6-in. long working at 180 pounds per square-inch. The boilers are operated under a system of heated forced draught. They are arranged abreast in the ship with no permanent bunker space in the stokehold below the twin deck.

The Foundation Co., of British Columbia, who established a shipyard in Victoria to build wooden ships for the Imperial Munitions Board, have recently taken over the plant of the Cameron-Genoa Shipbuilding Co. The latter plant was established to carry out a contract for six auxiliary schooners for the Canada West Coast Navigation Co., and later built several wooden steamers. It was on the completion of this work that the yard was taken over by the Foundation Co. Views are shown of one of the auxiliary schooners being built by the Cameron-Genoa Shipbuilding Co.

This yard has accepted contracts for twenty wooden steamers for French interests. The yard will be able to lay down ten of the boats at one time. The boats will carry about 2,500 tons D. W., and will be propelled by twin engines 14-in., 23-in., and 38-in by 24-in. stroke, giving a total of about 1,100 I.H.P.

The boats will be built throughout to the rules of the Bureau Veritas and that society's surveyors will also superintend the work of construction.

Yarrows, Ltd., of Esquimault, have continued turning out shallow draught stern wheel steamers for shipment to the far East. Their proximity to the Government drydock at the Navy Yard enables them to adequately handle large repair jobs. The Japanese steamer Canada Maru, which ran ashore in the Straits of Juan de Fuca, has just been repaired by them. This was a very expensive job, the cost running to over half a million dollars. The Princess Adelaide, one of the Canadian Pacific Railway Cos'. coasting passenger boats, was recently badly damaged on the rocks near Active Pass. She is at present in the hands of Yarrows, Ltd., for repairs.

Of the making of ships there is no end. Also there seems to be no end of things required to build and furnish a ship. There are very few trades which have not felt the stimulus of ship work. Winches, windlasses, ash hoists and all kinds of similar machinery can be seen in the various smaller machine shops, being made for local use and also for export.

The North Shore Iron Works have recently completed export contracts for winches and windlasses and the Schaake Co., have lathes which practically never stop, being kept busy on shafting forgings sent up from across the International Boundary and returned in a completed state for use in Uncle Sam's ships.

Whether British Columbia can continue in the steel shipbuilding business when competitive conditions are restored is a question often asked. There are only two reasons for an answer in the negative.

The logging camps and lumber mills are working full blast getting out material for wooden ships. As long as steel, which is, of course, the logical material for shipbuilding, remains difficult to obtain, wooden ships will be built and British Columbia is the right place to build them. A lot of adverse criticism was levelled at wooden ships when the idea of building them was first promulgated. Properly designed and built and reasonable care taken to prevent attacks of dry rot from the inside and of the torpedo from the outside, there is no reason why the ships that have been built and those that will be built should not have a long and useful life and be a credit to their constructors.

The enormous freight bill entailed by the rail haul from the Eastern States, where the bulk of the raw material is produced is a big item in the cost. This can be got over in two ways. There are large deposits of iron ore in British Columbia, there is lots of coal and limestone. Can British Columbia produce her own ship plate? In a very short time ship plates will be rolled on the Eastern Canadian seaboard and a considerable reduction in the freight bill ought to be obtained by shipping the material via Panama. This might prove a profitable cargo for the ships now being built for the Dominion Government.

The second item to be overcome is the higher cost of wages in the West. To overcome this perhaps the best solution is to give more for the wages paid. Not only the workman but every man in the yard, from the management down, must give an intelligent and cooperative day's work. By producing more the cost of production will be reduced. If we are to keep our yards going we must be prepared to offset the higher cost of labor by more efficient work. If we can do this we can compete successfully.

COMBINED RAIL AND ROAD TRUCKS

A scheme of which particulars were developed by Mr. Thomas Bennett, of Trelabe, St. Albans, England, contemplates the use of combined rail and road trucks. He would collect "loaders" provided with wheels which would permit them to be hauled over ordinary roads. On arriving at a station by road these loaders would be taken to a bank or platform raised to such a height as to be level with the flat tops of wagons or "chassis" running on the railway track. On this bank each of their wheels would be placed on "laterals" furnished with four small wheels or rollers and then they would be moved upon the chassis and secured in place. On reaching its destination the train would be taken alongside a similar bank and the loaders would be pulled off the chassis and removed from the laterals, to be subsequently delivered by road. Mr. Bennett claims various advantages for his plan, including saving of shunting and of handling goods, but whether or not these could be realized in practice the permissible height of the loads he could carry would be less than at present, owing to the limitations imposed vertically on the loading gauge by bridges and tunnels, and probably also the gross weight of the trains would be greater in relation to the paying load.

EFFICIENCY IN BELT DRIVES

In almost every factory and machine shop a certain amount of power is wasted in transmission through driving belts, the percentage of loss depending on the attention paid to the matter. Slipping, the trouble most frequently encountered, is common to all classes of belting, and generally speaking the remedy applied is to cut and tighten, or "take up," the belt, so that it will run free from slackness with a better grip of the pulley; but probably more belts are broken and prematurely destroyed in this way than by actual use, not to speak of additional load thrown on the engine and the consequent waste of power. To overcome slipping many engineers incline to the principle of using belts wider than is actually necessary. This permits a heavier load to be carried, but when the practice is generally adopted all over a machine shop with 50 or more belt drives, the cost is very considerable. There is, however, a growing tendency to run belts slack, as not only is friction thus reduced and the life of the belt increased, but no power is wasted and the strain on the prime mover is considerably reduced. Immediately the tension is reduced the friction is proportionately lessened. Further increase of the arc of contact round the pulley (after the belt has been sufficiently slackened to have no initial tension) will not lessen the friction, but the load-carrying capacity of the belt is increased. As an example, in many engineering shops it has been found that cuts 50 per cent. heavier can be taken on lathes where the arc of contact has been increased from 180° (with a tight belt) to as high as 220° (with a slack belt), and in one instance with a corn-crushing machine the increase in output was over 50 per cent. To permit of driving belts being run slack a proper belt dressing should be employed. Many belt dressings rely almost entirely on their capacity to "stick," due to the inclusion of rosin or tar in their composition. but others take the form of a non-stick preservative or belt food, free from acid or alkali action, which is absorbed into the belt. rendering it pliable and highly effective, and at the same time protecting it from the effects of moisture, dryness, or chemical fumes. Such a preparation properly applied tends to give belts a velvety cling through the setting up of a vacuum suction between the belt and the pulley face. and will permit of slack running without fear of slip, even under the heaviest loads.

Canada Controls Nickel Output of the World

Plant of the International Nickel Co. of Canada, Ltd., at Port Colborne, Plays an Important Part in Holding This Industry in All Its Stages to This Country Assures Canadian Control of Metal

By W. F. SUTHERLAND

View of refinery, showing main smelter building, machine shop, part of power house and nickel refinery.

FROM the earliest times, when man first emerged from the stone age, down to the present, iron and copper have been essential to his well being and progress. Other metals, amongst them tin, lead, and zinc, have also been of much value to him throughout the ages, but it is only within the last century that nickel has assumed the importance its properties entitle it to. By itself, its brightness, non-corrosive properties and hardness render it one of the most useful of metals, and alloyed with iron, it is almost indispensable in the present war.

The importance of nickel in the recent war lends particular interest to the refinery of the International Nickel Co. of Canada at Port Colborne, the first refinery to be built on Canadian soil, and its successful establishment marks a new epoch in the industrial development of the Dominion. It has long been recognized that it would be of great advantage to the country and to the Empire at large to have Ontario's nickel industry self-contained within the borders of our own province, and an agitation has been carried on for many years with this object in view. Economic conditions have, however, in the past prevented the attainment of this very desirable object, the long freight haul, and tariff on the necessary fluxes and other materials needed in refining have made it out of the question to refine at the mines. War conditions rendered it imperative that Canadian nickel be refined in Canada, and, after considerable study, Port Colborne was selected as a site where freight and other expenses could be reduced to a minimum, the longer haul on the materials imported being, in some measure, counterbalanced by the shorter haul from the smelter on the copper-nickel matte. Full advantage is also obtained from the lower cost of water haulage.

OFFICE BUILDING, INTERNATIONAL NICKEL CO. OF CANADA, REFINERY, PORT COLBORNE

Together with the establishment of the refinery at Port Colborne, the Canadian Copper Company underwent a change in its organization, becoming entirely a subsidiary of the International Nickel Company of Canada then formed. It may be emphasized that this company is not an American organization and that its policy is to employ Canadian engineering talent and labor as far as possible, a feature contemplated for a good many years, ever since the desirability of establishing the refinery in Canada was considered by the personnel of the company.

At the present time 34.5 per cent. of the payroll is Canadian, 1.8 per cent. American, 3.5 English, Irish and Scotch, and the remainder various nationalities, including some Chinese, a necessity arising from the present labor shortage.

Mr. More, the general manager of the plant, stated that his policy was to give employment to the returned soldier wherever possible, and that the results secured were quite in agreement with those experienced by other employers, their work in the main being very satisfactory, although considerable restlessness was much in evidence.

The most pressing problem to be faced in refining nickel is to secure labor, means to prevent the constant transfer of trained and partially trained help to other employment, necessitating the training of inexperienced men, and a consequent loss of efficiency would be welcomed. "We have the plant, and now we need the men," was Mr. More's summary of the situation. With all else provided for, the securing of labor is the largest issue to be faced in bringing about a rapid expansion in production in the newly-established Canadian nickel-refining industry.

Nickel as a Mineral

The geology of nickel and the location of the various deposits throughout the world are of considerable interest, and a knowledge of the mining and smelting of the ores is of value and may well precede the description of the refinery proper.

Contrary to popular belief, nickel-bearing ores occur in widely separated countries, Canada and New Caledonia having by far the largest and best deposits The United States has some workable deposits which were worked for many years until competition from New Caledonia rendered it unprofitable. These deposits are located in widely separated parts of the country, and some is still being obtained from the blister copper refined at Perth Amboy, near New York.

One other country in the Western Hemisphere may some time in the future prove to be a valuable source of nickel steel, since the vast iron ore deposits of the eastern end of Cuba carry enough of that metal to add to the value of the steel produced from its ores.

Nickel has long been obtained from European deposits, which were naturally the first sources to become known to the scientific world, although nickel alloys, pakfong, had been used by the Chinese long before. The first nickel was obtained by Crondstedt in 1751 from ores containing nickelite associated with cobalt minerals from Helsingland, Sweden; and a small amount of the metal is still being obtained from this source, though much less than from the neighboring country, Norway.

Norway contains no less than forty distinct outcrops of nickel-bearing ores, although at the beginning of the war only one mine was in operation. The ores are somewhat lean, containing only about 1.5 to 2.5 per cent. of nickel in the form of sulphides.

A number of other European deposits are of interest, such as the deposits in Piedmont and others near Horbach and Totmoos in the Grand Duchy of Baden, where ores containing 12 per cent. of nickel are found. Ores near Bilboa, in Spain, are reported to carry 6 per cent. nickel, 7 per cent. copper, and 3 per cent. of cobalt.

The deposits of nickel in Sweden, Norway, and particularly in the Duchy of Baden merit considerable attention at the present time, as it is altogether likely that much of Germany's war needs of nickel were supplied from these sources.

Nickel Ores of New Caledonia

Next to the Sudbury region the French colony of New Caledonia, 900 miles east of Australia, is the most important source of nickel in the world, the deposits having been first discovered in 1865 by Garnier. Deposits of nickel, cobalt and chromium are found in large beds on gentle slopes or basins on the flanks of the mountains; the nickel occurring as a hydrated silicate in which

JOHN MORE,
General Manager, International Nickel Co. of Canada, Refinery, Port Colborne.

the nickel has replaced magnesia to a greater or less extent. The richest silicates, which are green and soft, may contain up to 48.6 per cent. of nickel oxide, but their composition varies greatly.

It is interesting to note that the New Caledonia ores practically never contain sulphur, being silicates accumulated in beds through the weathering of the original rocks, while the nickel deposits at Sudbury are in the form of sulphides associated with those of iron and copper.

The Sudbury Region

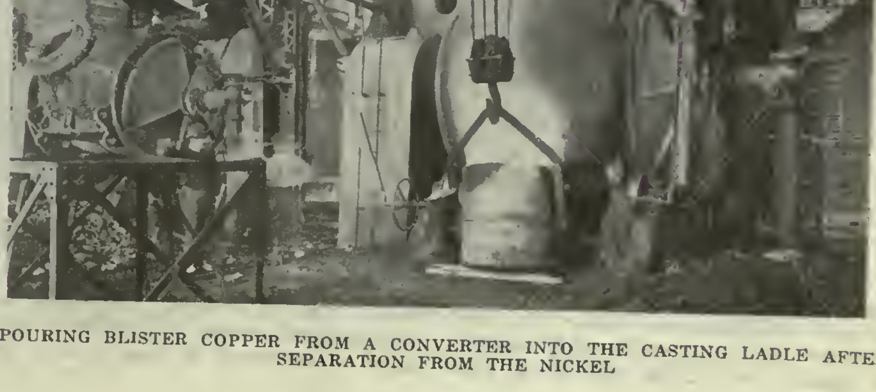
Sixty years ago, Northern Ontario, then a part of Upper Canada, was a wilderness, known only to a few Indians who made a living as best they might by hunting, fishing, and trapping. The timber resources of the country were untouched, the vast mineral resources were unknown, and the fertile farm lands of the clay belt were thought non-existent.

The first intimation that valuable ore deposits might be found in the regions at the head of Lake Huron was made in 1848, in a report by Sir William Logan, then provincial geologist. He mentioned the fact that in one instance copper pyrites was accompanied by compounds of iron and nickel, with a trace of cobalt and stated that it would appear singular that a region extending over a space of between one and two thousand square miles, and giving marked indications of mineralization, did not, in the course of time, yield man valuable results.

From that time onward, various discoveries of copper and nickel-bearing ores were reported by various geologists and surveyors, who traversed the country, nickel being found at several places somewhat remote from what is now known as the Sudbury region. Nickel was first reported from this region by Murray in 1856. The well-known land surveyor Salter first reported indications of iron near the present Creighton mine, the greatest nickel mine in the world, his compass needle being very materially deflected by the iron with which the nickel is associated in the ore, and at his suggestion Murray investigated the deposit, finding copper and nickel.

As is often the case, the opening up of a country by improved transportation leads to its rapid development, and the utilization of its natural resources. The running of the Canadian Pacific in 1883 through the Sudbury district in this particular instance effected the discovery of important nickel deposits, as in the making of a cutting the excavation was carried through the ore body of what was afterwards known as the Murray Mine.

This exposure on the C. P. R. right of way gave the public some inkling as to



POURING BLISTER COPPER FROM A CONVERTER INTO THE CASTING LADLE AFTER SEPARATION FROM THE NICKEL

INTERIOR VIEW OF LABORATORY—ALBERINE FUME CABINETS AND TABLE TOPS ARE USED

the value of the minerals to be found, and the country was quickly prospected, most of the important deposits of nickel and copper ores being found in a short time.

Geology of the Sudbury District

The nickel region has sharply-defined boundaries of a geological nature, since all the ore deposits are connected with a great sheet of eruptive rock, roughly boat shaped. Only the upturned edges of the sheet are exposed, since it is basin shaped and has its interior filled with sedimentary rocks. The basin is thirty-six miles long and about sixteen miles wide, and the known ore deposits are all either along the edge of the sheet, or less than four miles away from it on projections or offsets.

The Sudbury ores contain essentially only four ingredients, a magnetic sulphide of iron, which is practically free from nickel and copper, a sulphide of nickel and iron, a sulphide containing equal parts of iron and copper, and a variable amount of rock matter of several kinds. Some of the ores are low in copper and high in iron, and if these could be selected so as to contain only a minimum amount of copper, the large amount of iron present in the ore could be used directly in the production of nickel steel and much expense avoided. Recent researches have demonstrated that under certain conditions copper is not detrimental to steel, and it is possible that some method may be developed which will render possible the saving of the iron content in the form of a steel containing both nickel and copper.

The Canadian Copper Co.

The history of mining and smelting in the Sudbury region is so closely bound up with the Canadian Copper Co., now absorbed by the International Nickel Co. of Canada, that a good idea of the processes connected with the smelting of the ores may be gained by following the various operations as they are conducted at this company's smelter at Copper Cliff.

The valuable constituents of the ores are nickel and copper, and these two metals must first be separated from the useless materials and then from one another. The first step is the elimination of much of the sulphur found in combination with the nickel copper and iron of the ore, and in the past this has been largely accomplished by heap roasting, although it is anticipated that this process, destructive to vegetation and wasteful of sulphur, will soon become a thing of the past. For heap roasting, a flat, well-drained surface is prepared, and a layer of cordwood or dead pine is laid down to a depth of a foot or eighteen inches. On this bed coarse ores are placed, followed by medium ores, and finally by fines. The heap, when completed, contains up to 2,000 or 3,000 tons, and has a trim, rectangular shape, with flat top and sloping sides. The wood is set fire to and burns out, by which time the sulphur is ignited and burns without further assistance. The larger heaps require three or four months to burn, and at the end of this time all but about 10 per cent. of the sulphur has burned off and the iron is more or less completely oxidized.

After roasting, the ore is smelted in water-jacketed furnaces to standard matte. These copper blast furnaces are rectangular in shape and can handle about 500 tons of ore per day. The ore from the several mines owned by the company, owing to the large proportion of iron and admixture of rock with the sulphides, can be blended to form almost self-fluxing mixtures, but quartz is added as required to produce a further oxidization. The smelting results in two products, matte and slag. The matte contains practically all the nickel and copper, with much of the iron. The matte from the blast furnace is next poured into basic converters, where the remaining iron is oxidized in much the same manner as is the carbon in the familiar Bessemer converter of the steel mill. The iron passes out in the slag resulting from the operation, and a standard matte ready for refining results. This matte contains very nearly all the nickel and copper, very little of the iron, and a high percentage of sulphur. The matte is sent to the refinery at Port Colborne, where the copper and nickel are separated and refined.

THE PORT COLBORNE REFINERY

On approaching the refinery one is favorably impressed with the excellent architectural features of the administrative and other buildings forming a group at the entrance.

INTERIOR OF MACHINE SHOP

COTTRELL PRECIPITATION PLANT—SEVEN 25 KW., C.G.E. MOTOR GENERATOR SETS SUPPLY ALTERNATING CURRENT TO THE STEP-UP TRANSFORMERS

The comfort and health of the large staff have been given considerable care, and the result is shown in the staff house provided for employees, and in the club house for the accommodation of the unmarried department and executive heads. This latter building contains recreative features such as bowling alley and billiard rooms, in addition to the living accommodations provided.

Adjacent to the administrative building is located the combined garage, timekeeper's office, and hospital. The garage forms the lower or basement story, with the timekeeper's office immediately above. The hospital forms a somewhat detached portion of the building and is an extremely well appointed and necessary part of the plant. Its need may be realized when it is known that the nearest hospital of any kind is at Welland, some nine miles away. An examination room is provided for the reception of the patient and for the administering of first aid; a ward room is also in readiness for any bed cases, and a completely-equipped operating room with table and sterilizers has been fitted out.

Laboratory

The laboratory is housed in a separate two storey and basement building, and besides the offices necessary, contains the man laboratory and balance rooms. The laboratory has been fitted throughout with alberine or soapstone tables and a central fume hood with ten compartments has been arranged around a central stack. Each compartment is also constructed of alberine and has wire-inserted plate glass sliding doors with marble trim. The balance room is equipped with the usual precision and assay balances carried on an alberine slab free standing from the building, and supported on brick piers carried to bed rock.

Transportation Facilities

Railway sidings from the Grand Trunk enter the company's property from the north. These sidings serve every portion of the plant, and all handling of materials by hand being eliminated.

The furnace building, known as the No. 1 building, is 746 ft. in length by 125 ft. in width, and at present houses three blast furnaces and three convertors. The matte received from the smelter at Copper Cliff undergoes its initial treatment here, and the method of handling the raw materials is of interest. The matte, coke and fluxes are brought in on an elevated trestle of reinforced concrete, and which displays excellent design and workmanship. From the cars the materials are dumped into elevated storage bins, from which it goes to the feeding floor and thence to the furnaces. The standard matte, 55 per cent. nickel and 24 per cent. copper, is smelted with saltcake, the nickel separated and the copper bessemerized in the convertors. These convertors are of Allis-Chalmers make, and are of 84 in. by 126 in. size. Electric tilting gear controls their movement. Besides these convertors this company supplied two sets of crushing rolls and a sample grinder.

Removal of Fumes and Gases

In the various operations conducted in the No. 1 building much sulphur is given off in the form of sulphur dioxide gas, and to remove this and disperse it in such a manner as to prevent damage to vegetation has been a problem of some magnitude. Each convertor has a stationary hood and also a movable one for use when pouring, through which all of the deleterious gases are removed and conducted to the stack. For the removal of dust and a valuable metallic content, the gases, before entering the stack, are subject to the familiar Cottrell precipitation process.

The Cottrell Precipitation Process

For many years there was no known process by means of which dust and other objectionable matter in flue gases and in the gaseous products of metallurgical operations could be completely eliminated. The Cottrell precipitation process, a somewhat recent development, has been applied to these uses with such success, however, that it has been well established as a standard means of removing fine particles of material such as dust, fumes, acid, mists, etc., from the gases resulting from the smelting and refining of copper, lead, zinc, and other metals.

The installation of this system in the refinery at Port Colborne is one of the largest and most successful in North America, and is admirably planned for the work it has to do in the elimination of many of the noxious elements of the gases and in the recovery of valuable metals.

A brief description of the fundamental principles underlying the electrical precipitation process will be of much assistance in understanding the operation of the plant. A body highly charged with electricity, if of small enough diameter, or with sharp points, discharges electricity silently through the surrounding air. The corona discharge surrounding high tension lines under certain conditions,

COPPER CONVERTERS IN REFINERY BUILDING

B. & W. BOILERS SUSPENDED BUNKER, AND CHAIN GRATE STOKER

and visible as a pale light, is an analogous condition. Some of the electrical energy thus discharged is imparted to any particles of matter in the immediate vicinity, and they in turn are transformed into charged bodies (positive or negative as the case may be). As bodies charged with electricity of the same sign repel each other, all such particles will, if free to move, be violently repelled from the fixed electrode or charged body, and will be attracted to a body of opposite polarity.

The essential elements in a precipitation plant then are a source of high potential direct current and the two electrodes of opposite polarity. One set known as the discharge electrodes, are of such form as will facilitate an electric discharge from their surface. This is accomplished by making them in the form of a wire or light chain or a strip of metal having relatively sharp edges. The other set of electrodes known as the collecting electrodes, are of such shape as to prevent as far as possible any discharge from their surfaces, in this case, in the form of a pipe with a smooth bore.

These electrodes are so arranged in the precipitator that the different types oppose each other, and between them a silent or glow discharge is maintained by supplying to the discharge, electrode energy of a unidirectional character. The collecting electrodes are grounded for safety, the ground being used as the return circuit.

In this refinery the fumes from the copper converters are collected by hoods and carried away in two collecting flues, which unite at the base of the stack. These flues are of concrete and steel construction and are lined with brick. The gases on the way to the stack pass through the precipitating tubes which are arranged in two separate groups, one serving each flue, and all particles of suspended matter are driven to the enclosing walls and drop into suspended bins below, from which they are removed from time to time by means of the company's railroad.

Energy is supplied by means of seven 25 kw. motor generator sets of General Electric make. These motor generator sets take current from the d.c. busses and transform it into low-tension alternating current at sixty cycles. A step up transformer for each set serves to step the voltage up to 100,000 volts, at which potential the current is commutated and led to the precipitating tubes. The commutator is a bakelite disc about thirty inches in diameter and is keyed to the end of the motor-generator shaft, thus keeping it in exact synchronism with the alternator frequency; two metallic sectors are attached to the disc and the current is transformed into a uni-directional current by means of fixed sparking contacts, no mechanical connection being necessary.

From the precipitator the flue gases pass into the stack, which is 350 ft. high and 12 ft. internal diameter at the top. This stack, together with all others at the plant, is built of reinforced concrete, and was erected by the General Concrete Construction Co.

Air Supply

The converters and blast furnaces require a large volume of air, and for this purpose three high-pressure turbo-blowers are installed in a separate building. These blowers are made by the Ridgway Dynamo and Engine Co., and have each a capacity of 7,500 cubic feet of free air per minute, at 30 oz. pressure. The blowers are individually driven by high speed direct current motors at 3,600 revs. per min.

INTERIOR VIEW OF POWER HOUSE, SHOWING WEBSTER-LEA HEATER METER, INGERSOL-RAND COMPRESSOR, PUMPS FOR PLANT WATER SUPPLY AND TURBO-GENERATOR

EXTERIOR OF POWER HOUSE

Further refining of the nickel is done in the No. 2 building, and one of the most interesting features of this portion of the plant is the comprehensive arrangement of the mono-rail system. The bottom chords of the roof trusses have been designed to take care of the additional load, resulting from the mono-rail system and Shepard crane and hoist mono-rail trolleys serve every portion of the plant. Safety features, suspended walks and runways are provided, and it is impossible for any car to run off an open switch or otherwise do damage to itself or to another.

A stack of the same size and construction as that serving the No. 1 building serves to carry away and dissipate in the upper atmosphere all fumes from the roasting ovens here installed.

Power Plant

In common with the remainder of the refinery, the power plant shows evidence of careful planning and considerable attention to future conditions. The equipment at present installed is capable of taking care of a considerable extension to the plant, and ample space has been provided for future extension both of the boiler house and turbine room.

The building is of the usual brick, steel and reinforced concrete power house design, and the equipment has been arranged in an attractive layout.

The main power house boiler room contain four Babcock and Wilcox standard water-tube boilers, each of 4,319 square ft. heating surface, set in two batteries, These boilers are built for a working pressure of 160 pounds per square inch, each being fitted with B. & W. superheater, which superheats the steam about 100°. B. & W. chain grate stokers are also fitted.

Two B. & W. boilers of special design are also installed for utilizing the waste heat from the reverberatory furnaces of the nickel refinery. These boilers are designed for a capacity of approximately 400 boiler horse power each, and are of particular interest as they represent the latest design in waste heat boilers developed from very extensive investigation into this class of work by the Babcock and Wilcox Company.

Coal and Ash Handling

Coal is received from the cars in a track hopper crushed in a Jeffry single-crushing roll, elevated, and conveyed overhead to a suspended bunker, from which it is fed as required to the stokers.

The ashes are removed from the ash pits by ash cars running in an underground tunnel to the elevator and ash storage bin from which they are dumped into cars for removal.

One 6 ft. by 175 ft. reinforced concrete chimney conveys the products of combustion from the boilers in the power house. The waste heat boilers are served by two 5 ft. x 10 ft. reinforced concrete stacks.

Turbines and Generators

Two Ridgway-Rateau high pressure turbines furnish power for the direct connected d.c. generators, each of 1,000 kw. capacity. These turbines operate under 150 pound initial steam pressure, and 28 in. vacuum, and run at 1,700 revs. per min.

The power house also contains two other turbo-driven units, these being high pressure blowers supplying air for the converters. Like the turbo-generators, these units are of Ridgway-Rateau make. The turbo-blowers are each of 15,000 cub. ft. capacity, and deliver air at 15 pounds pressure. They are connected to high pressure condensing turbines operating at 8,500 revs. per min.

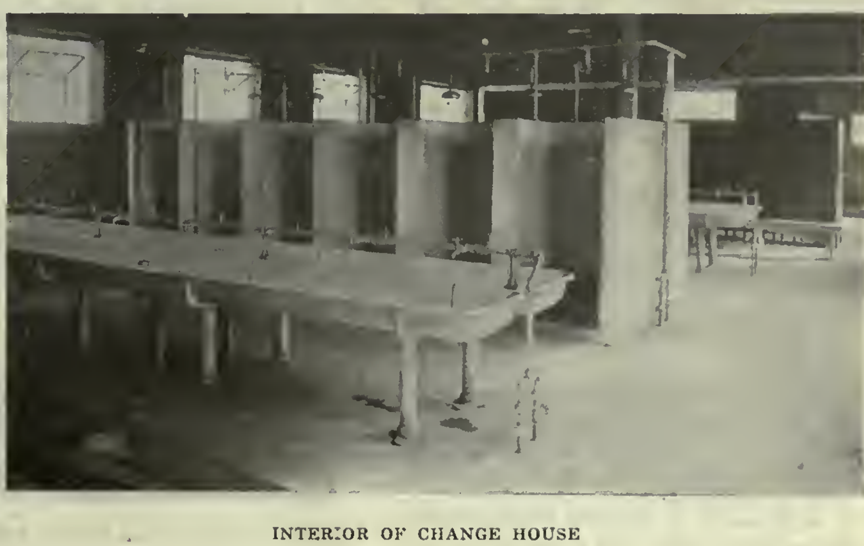
The superseding of the reciprocating engine by the turbine in the large power plants has provided the means for the elimination of the cumbersome blowing engine. The high rotating velocities obtainable to-day are especially well adaptable to the driving of centrifugal blowers, and the turbo-blowers at this plant are much more economical of space than blowing engines of similar capacity would be.

The impellers are built up around a large diameter shaft with dovetail radial slots milled in it. The impeller blades are tapered in section, being much thinner at the tip than at the root, and are driven into these slots, distance pieces being inserted between the blades in several stages. All turbines are equipped with Frahm tachometers, supplied by James Biddle, Philadelphia.

Condensing Equipment

Two No. 7 Westinghouse LeBlanc jet condensers, with individual air and circulating water pumps serve the turbo-generators. Each unit is fitted with a 31 h.p. steam turbine and reduction gear for pump drive. These condensers are each capable of handling 17,500 lbs. condensate per hour, and maintain a 29 in. vacuum, with 40° cooling water.

For the turbo-blowers two similar No. 5 units are installed. These are fitted with 21 h.p. steam turbines, and are capable of handling 11,000 lbs. of condensate per hour, at 29.05 in vacuum with 40° cooling water.



INTERIOR OF CHANGE HOUSE

Electrical Features

The main switchboard supplies the plant load with direct current at 250 volts, lighting and other 110-volt services being supplied by means of a three-wire service operated by two 20 kw. motor generator balancing sets. I. T. E. circuit breakers, Weston indicating ammeters, and Sangamo wattmeters are installed on the generator and feeder panels.

Feed Water Equipment

The feed water is heated by exhaust steam from the various plant auxiliaries in Webster-Lea heater meter units. The heaters were supplied by Warren Webster and Company, Camden, N.J., and the Lea meters by the Yarnall-Waring Co., Philadelphia.

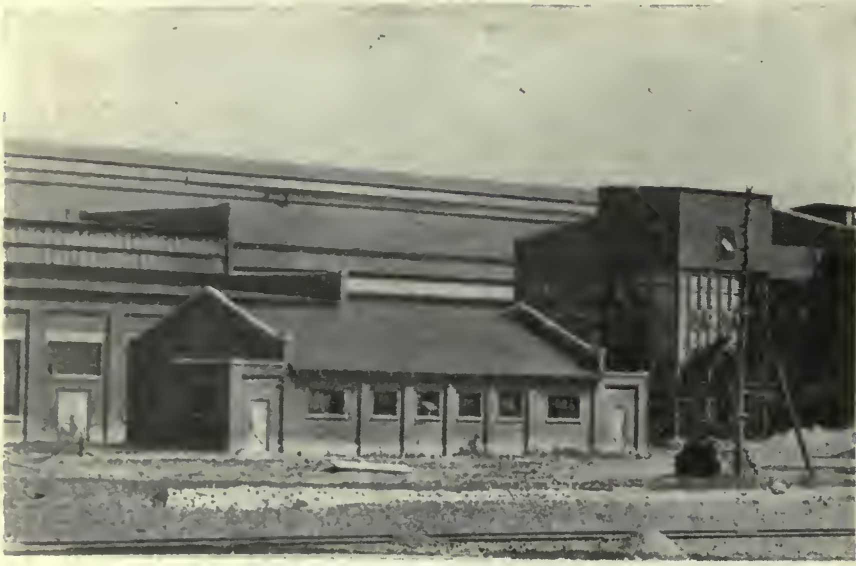
Two units were installed, one heater good for 5,000 h.p. equipped with Lea recorder, and having a capacity of 275,000 lbs. per hour, and another unit similar in construction to the first and having a capacity of 1,500 h.p., or 100,000 lbs. per hour. Both units are of extra heavy construction and were designed to withstand a back pressure of 10 lb. per sq. in.

A two-inch venturi meter meters all feed water, and the feed pumps are of Lea-Courteny make, direct-connected to Terry steam turbines of standard type. Owing to the horizontal parting of the casing, these turbines are very accessible for repair, and the fact that no oil comes in contact with the steam renders the use of an oil separator on the exhaust line to the heaters unnecessary.

Machine Shop

In a plant of this size facilities for the repairing of machinery are not only advisable but necessary, and ample provision has been made for this work in the machine shop forming a portion of the layout. The building is ample in size and has space to contain a large amount of equipment, and while the installation is not yet complete and while the machinery is not as yet installed in permanent position a very good idea of equipment may be gained from its enumeration.

A 12 and 28 in. McKabe double spindle lathe with a 24-ft. bed takes care of all the heavier turning required, while a Willard engine lathe serves for the finer and smaller repair jobs. A Hamilton drill is located adjacent to the lathes and a Niles-Bement-Pond radial drill is also installed. A Bertram double punch and shear, Kelley shaper and Racine hack saws also form part of the equipment. The machine shop building is about 175 ft. wide and about 200 ft. long with two side bays and center aisle for crane runway and also serves to house the forging equipment and a complete electrical repair shop. All repairing is done here and no work is sent outside, armatures and field coils are rewound and a stock of repair parts is kept on hand.



ONE OF THE SIX CHANGE HOUSES FOR EMPLOYEES

In addition to the machine shop a separate building houses a carpenter shop, which not only does any carpenter work required, but also serves as a cooperage in which all the stout barrels are assembled for shipping a portion of the company's product.

Sanitary Conditions

In a plant of this magnitude it is manifestly a wise thing to take provision for the workman's health and the sanitary features of the plant show a considerable amount of care and thoughtfulness in their working out.

All water used in the plant is chlorinated; this means not only drinking water, but every bit that is used in plant operations as well. The water supply is obtained through a four-foot square intake from the Welland Canal, is passed through the pumps, chlorinated and goes to an elevated tank, where time is given for its complete purification.

The company operate their own sewage system, all sewage being received by a sump, elevated by air ejector pumps and purified in activated sludge tanks located some distance from the buildings on an elevated piece of land.

To workmen engaged in laborious occupations provision must be made for the changing of wet and dirty clothing and the donning of comfortable and warm clothes for street wear. To this end four change houses have been built with a total of 600 lockers, hot and cold showers and lavatory accommodation.

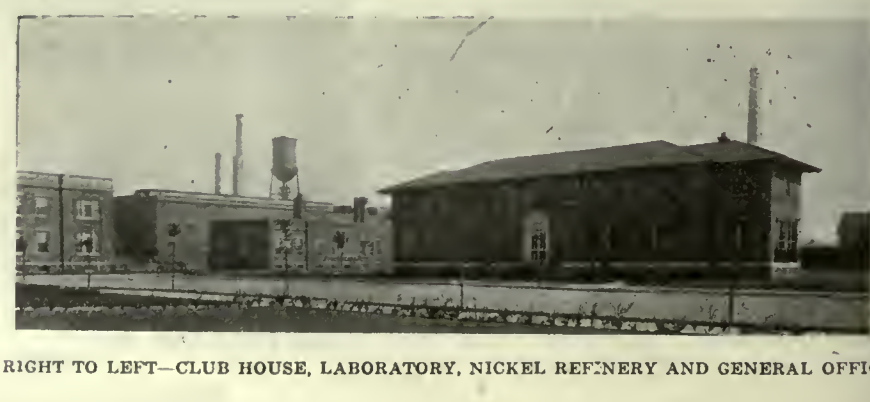
While the Port Colborne refinery is designed to have an initial output of about one-fourth that of the Bayonne plant, New Jersey, the present buildings have been constructed with a view to enlargement and it is probable that ultimately the entire output of the Sudbury mines will be brought to Port Colborne for refining. Future plans may also take into consideration the establishing of coke ovens. It is the opinion of the officials of the company that the nickel refining industry has come to Canada to stay, and while many obstacles have been encountered, many of them due to war conditions and labor scarcity, the industry is on a firm footing.

Production

While the refining of copper has been carried on for some time it has only been since the end of September that any shipments of nickel have been made. When the Canadian refinery is in full operation it is estimated that it will have a yearly production of 15,000,000 to 20,000,000 lbs. of nickel and 8,000,000 lbs. of copper.

The site of the refinery is large enough to permit of considerable extension, in all 350 acres, and the buildings are laid out in a manner that will readily facilitate such extensions as may be needed in future. The plant is estimated to cost approximately $5,000,000. Equipment and buildings alike have been chosen with a view to permanency, so although the initial charges are high, owing to war conditions, depreciation charges will be low in compensation.

All buildings are fireproof throughout, being constructed of brick, reinforced concrete and steel. The Foundation Company of New York and Montreal had charge of all work and were responsible for much of the design, in association with the company's own engineering staff.



RIGHT TO LEFT—CLUB HOUSE, LABORATORY, NICKEL REFINERY AND GENERAL OFFICE

Canadians Quick to Learn the Steel Business

Superintendent Had to Rely on Green Crew to Run His Plate Mill, But It Was Not Long Before Record Shipments Were Being Turned Out—A Good Source of Employment For Mechanics

By T. L. CROSSEN, Superintendent Plate Mill, Dominion Foundries and Steel, Hamilton

THE steel rolling industry in Canada, especially the rolling of plates and sheets, being a comparatively new industry here, and not well understood or appreciated by the average Canadian as a means for bettering the industrial conditions and labor markets of Canada, it might be in keeping with the reconstruction period of the present time, to point out some of the benefits to be derived from the steel rolling business and some of the things most desired and necessary in the way of organization and conditions to successfully operate a rolling mill.

The first thing necessary for the operation of a rolling mill, as well as any other business, is men. Men not of the ordinary slip-shod type, but men with determination and initiative, with the disposition to do a good day's work and expect a good day's pay for doing it—men who learn something each day from their work, and put it into operation in their next day's work, or in short, men upon whom you can depend.

There are so many good inducements for young men in the steel rolling industry that it is impossible for the writer to see any other line of employment that offers anything nearly so good. The work, while rather hard and exacting, possesses features which are found in few lines of work, and it has rather a gripping attitude from which a man never wants to get away, and the actual experience he gains is a stepping-stone for a splendid future.

T. L. CROSSEN,
Supt. Plate Mill, Dominion Foundries & Steel, Hamilton.

While the man of ordinary or practical education is always a valuable asset in a steel mill organization, and is able to command a much better wage than men of other trades, still the man with the technical and practical education is the fellow who goes to the top and stays there, and the young man who comes into a steel mill equipped with a good education and determination can't be stopped until he reaches the top. But you will find him as diligently studying his text books and trade papers as though he were still at school.

The Canadian seems to take to the steel rolling business as a "duck takes to water," and as an example of the fact, the following speaks for itself. The writer came to Canada some time back to install and operate a small steel plate mill, and before leaving the U.S.A. he rounded up a good operating organization and had everything shaped to bring them on just as soon as the plant was ready. In due course of time the mill was installed; he went back for his organization, when it was found that, owing to war conditions, it was impossible to bring but two men back, as some were already in the regulation uniform and the others being exempted from military service just so long as they stayed on their jobs, which was war work. There was just one thing left to do, that was to come back to Canada, break in a green set of men and get down to business. This was in the fall of 1917 and so well did these "Green Canadians" break in that by early spring they were turning out as much steel plate as most of the old organized mills across the line, and during the summer record shipments were made, which the writer believes have not been beaten by any one with a mill of the same type and size anywhere. These boys all had the necessary spunk to stick with the game until to-day they are capable of holding their own in any company, but one difference noticeable between the Canadian and the American workman in rolling mill practice is that the Canadian does not take his job quite so seriously as does his cousin on the other side, the result being that he doesn't report for work with the same regularity as does the American. But if the Canadian is given the chance to show in the steel industry he will send an industrial thrill throughout the world, because the kind of men that went up Vimy Ridge are not to be denied, and are perfectly capable of holding their own against any set of men on earth at any line of work to which they might turn.

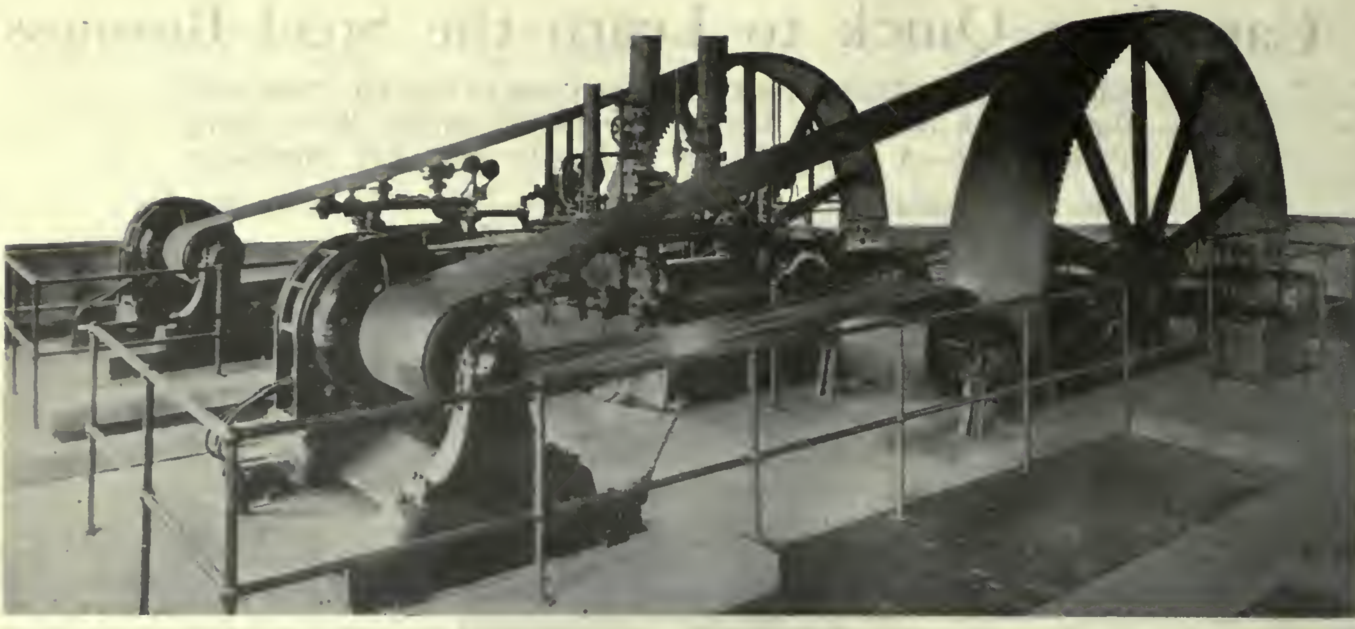
"What a man knows is a club for himself, and what he don't know is a meat axe for the other fellow," and the young man coming into a rolling mill equipped with a large-sized meat axe will be standing firm on his own job with his hands within speaking distance of the superintendent and looking square into the eyes of the manager, and his salary arm will soon grow long enough to reach quite a distance through the cashier's window.

In concluding, it might be well to say that so far as one is able to judge, there is no reason in the world why Canada is not sending finished rolled product to all corners of the earth, and if the Government at Ottawa will get back of the manufacturers in the way they should, we will see young Pittsburghs and Sheffields scattered throughout the Dominion, because the men, money and material are here.

Back in the 'Eighties the tin plate industry in the U.S.A. was nil, and every pound used was imported, mostly from Wales. The Government got busy in the matter, an investigation was made and the McKinley Protective Bill was passed and became a law, with the result that tin mills seemed to almost spring up over night throughout the country, and to-day the U.S. is one of the largest producers of tin plate in the world. What happened there can happen here, and right now is the time to make it happen.

The great Edison says: "All comes to him who hustles while he waits."

The development of the explosive and propellant industry in Canada has been an important achievement. It has been the policy of the Munitions Board to to establish national plants for the purpose of stimulating any important line of production which private enterprise was unwilling or unable to carry on, and seven of these plants, representing a capital investment of $15,000,000, were operated under the immediate direction of the board. The two largest manufactured explosives, and these, with privately owned plants, produced upwards of 100,000,000 pounds of high-grade explosives and propellants.



Effective Transmission Most Essential to Economy

Treatment of Shafting, Pulleys and Belting is All-Important—Various Details of Designs and Installations, as Well as Operating Features—Care of Belting and Proper Application of Dressing

By J. H. RODGERS

AMONG the many features involved in the problem of production few are more important than that of effective transmission of power from the primary unit to the machine that is performing the work. Very frequently, output is restricted owing to the failure of some part of the power installation, or the neglect in correcting some fault after the same has become evident. Too much attention cannot be given to this essential feature of plant operation. The treatment accorded to shafting, pulleys and belting, should be considered one of the fundamental details upon which the efficiency of the shop is based. No plant can expect to maintain a high average of production unless the transmission is constantly kept in the best condition. To accomplish this it is very advisable—and in large factories almost essential—to place the maintenance of this branch of the work under the supervision of one experienced party, a man that can give his entire time to the work, and with assistants if necessary. Where every machine operator is permitted to repair his own belts, tighten or adjust pulleys, effective operation is a doubtful factor. While it may be true that some men are thoroughly familiar with the peculiar and ofttimes apparently insignificant features relative to belt repair and upkeep, it is nevertheless good practice to have the transmission maintenance in charge of a man or gang especially selected for the purpose. We say selected in preference to appointed, as it is particularly advisable that the men doing the work of installation or repair, should know why they are doing it as well as how they are doing it. The various conditions under which a belt man has to perform his duties enables him from experience to evolve ways and means to maintain the maximum efficiency from the belts and pulleys under his charge.

The compilation of the following article is the result of observation and experience in the use and abuse of transmission equipment, and is here set forth as an aid to those who have, or may have, to do with the installation and subsequent repair and maintenance of shafting, pulleys, belts and accessories. In the unit system of machine operation, where each tool is driven by its own individual motor, the installation of overhead shafting is seldom required, but where the group system is adopted it is invariably a necessity to have a line of shafting to distribute the power to the different machines located about the shop. In general practice of to-day the group drive is so proportioned that the use of long lengths of shafting is vir-

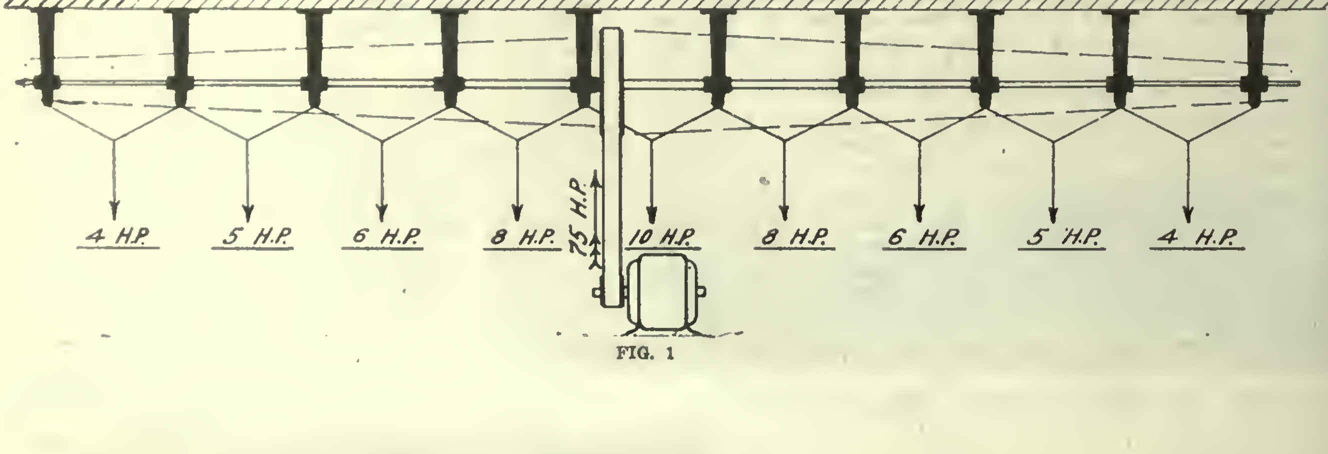
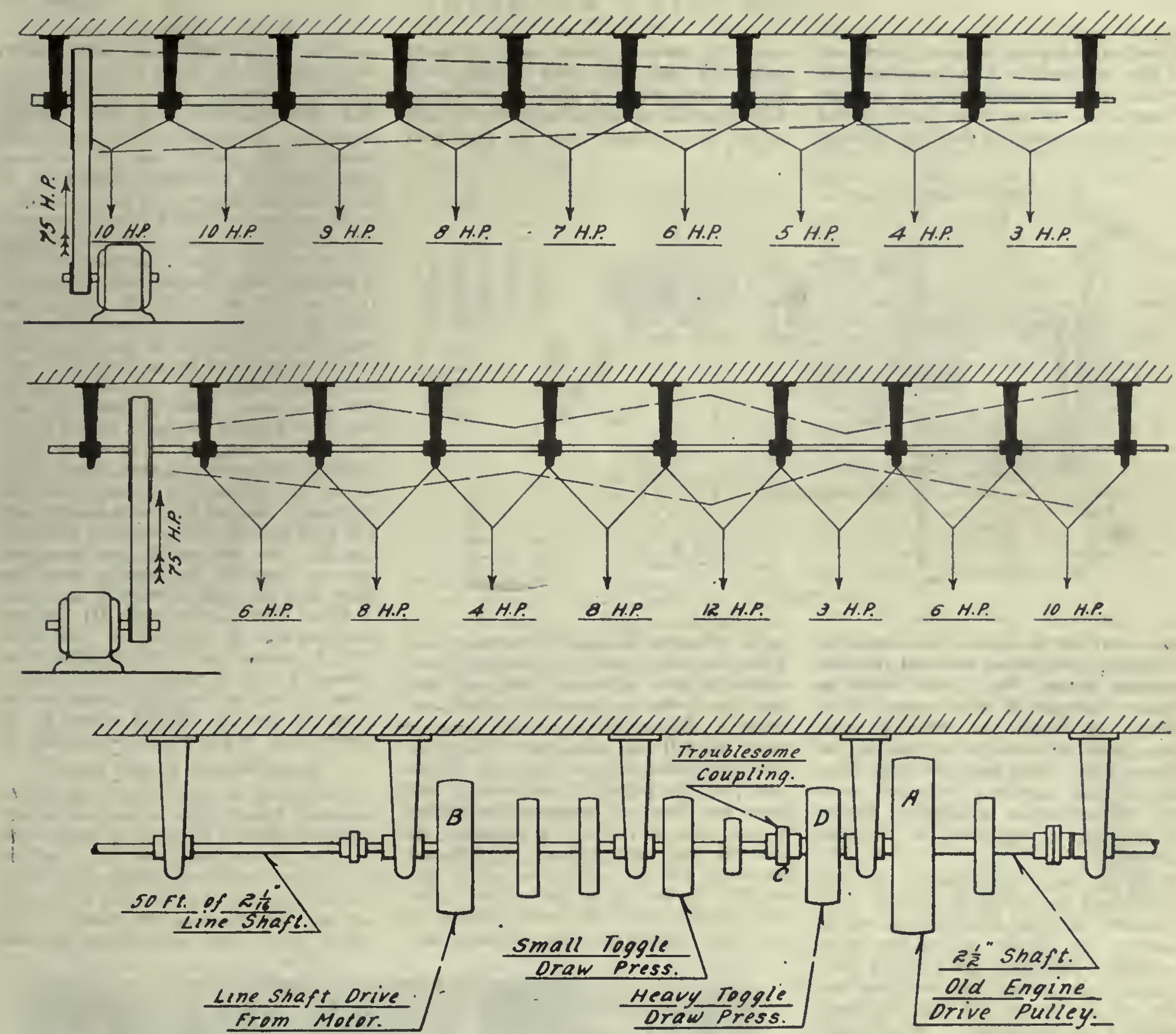


FIG. 1



FIGURES 2, 3 AND 4

tually eliminated, and where main shafts of excessive length are used it is considered an economic feature to arrange the power distribution in such a way as to minimize the torque throughout the shaft. This twisting action may often be so great as to develop a grave source of annoyance and may eventually necessitate the rearrangement of the drive to overcome the trouble. Very frequently, an installation of machinery may be made in a plant, or additional units located in available space, with but little thought of the source or distribution of the power required to operate the different machine tools.

Minimizing the Shaft Torque.

In determining the position of the machines in a group, or when adding a tool to the existing equipment, the volume of power required to operate, and the special purpose of the machine, are two factors that should be given careful consideration. If this is not done the efficiency of the machine may fall below expectations, and be prematurely condemned. Wherever possible—and it is advisable in all cases—the heavier machines that require a proportionately high percentage of power for their operation, and particularly in cases where the consumption of power is spasmodically varied from light to heavy load, should be located as near the source of line shaft power as conditions will permit. While no fixed rule can be applied for installations of this character, owing to the fact that no two plants are identical in their layout or production requirements, a general recognition of stabilized distribution would meet the end desired in practically every instance.

It is seldom that the entire power developed by the engine or motor is consumed in the operation of the equipment, so that in initial installations allowance is always made for subsequent units to be operated from the primary line shaft. The character of the motor support is very important, but is dependable upon local conditions. Good results are obtained by locating the motor on the ceiling or on a specially constructed concrete base. The former practice provides more available floor space, but the latter assures a more stable foundation and more accessible for repairs. Where a support of this kind is not permissible, a substantial timber framework may be constructed to carry the motor, which may be located on the floor, wall or ceiling. The fundamental requirement. however, it to have the support rigid enough to eliminate all vibration, a condition that is invariably the progenitor of many motor troubles.

Location of Motor Drive

It is good practice to locate the driving motor about midway of the line shaft length, as illustrated in Fig. 1. When delivering to, or taking power from a line shaft, it is advisable to place the pulley as close to the hanger as possible, and this rule applies in particular to heavy drives or those where the absorption of power is intermittent, such as the operation of machines requiring a flywheel for stability, as in power presses, punching and shearing machines, and like equipment. In placing machinery in a shop it should be the practice to locate the heavy tools close to the main drive so that the twisting moment

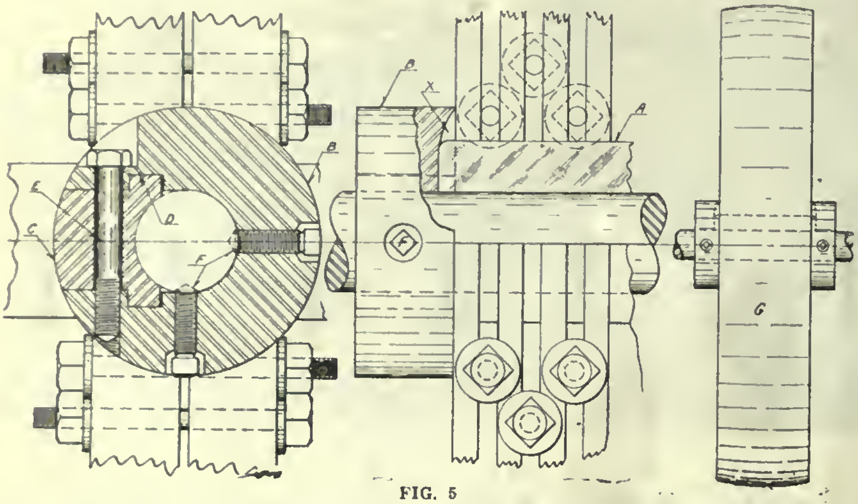


FIG. 5

in the shaft will be kept at the minimum, the lightest tools being situated farthest from the motor. Fig. 1 will serve as a good example of the central drive method; this shows the reducing value of the power delivered when nearing the extreme ends. This, however, is an ideal condition and can only be taken as a guide for an actual installation, theory only serving as an assist to practical adaptability.

When the drive is located at one end of the shaft, as shown in Fig. 2, it is imperative that the heavy machines be placed at the motor end of the shop. The farther such tools are situated from the motor the greater the twisting moment of the shaft and the increased possibility of line shaft. When main shafts are of extreme length it would be well to adopt a reducing size of shaft to aid in overcoming the shaft torque. An example of a line shaft drive that should be avoided is shown in Fig. 3. Here the drive is on the end, the diameter of the shaft uniform throughout its entire length, and the power delivered very irregular, factors that would provide excellent opportunities for inefficient operation. The skeleton lines show the varied fluctuations in the power delivered, and the great possibility of troublesome torque is quite obvious.

Inefficient Installation.

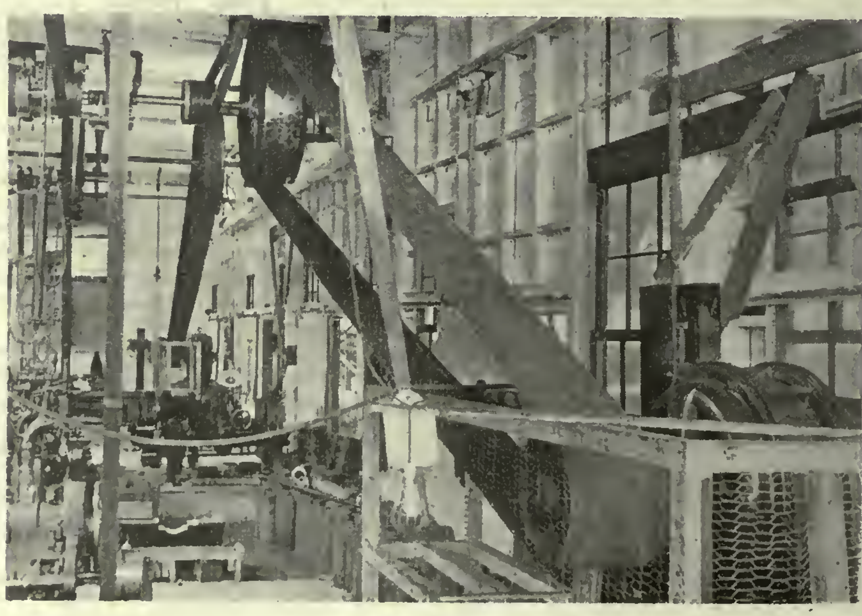
A special instance of ineffective line shaft drive is diagramatically illustrated in Fig. 4. In prehistoric days this shaft was driven by a steam unit belted to the large 6 foot cast iron pulley A, keyed to the length of 2½ inch shaft. The advent of the motor placed the engine in the discard and the new source of power was at the pulley B, the size of the entire line shaft, apart from the length above mentioned, being 2 1-16 inches in diameter. To the left of the drive, pulley B was approximately 50 feet of shafting carrying pulleys for operating various presses and other small tools. To the right was a couple of punch presses and a small draw press. Adjoining the reduction coupling C, and on the larger shaft, was the four foot pulley drive for the heavy drawing press. When the latter was in operation, more especially when on heavy drawn work, the coupling C was a source of constant annoyance, giving out a continual squeak when the full load came upon the press. This particular trouble was laid to the fact that the pulley A was out of balance and had an apparent oscillating motion, due to its poor alignment. Its removal was contemplated on different occasions, but no determined effort was made to do so. It is the writer's opinion, however, that the primary cause of the shaft trouble was the inefficient method of the drive itself, and the location of the heavy draw press in relation to the motor drive.

Cure for Slipping Pulley

In addition to the trouble arising in the coupling C, the pulley D, that operated the large draw press, could not be kept tight on the shaft and would persist in slipping when the extreme load came upon the press; this slip was invariably accompanied by the usual squeak. This pulley was of the wood split type but persistent tightening of the clamping bolts was of no avail. Sand paper and emery cloth was tried between the bushings but only provided a temporary relief. Holes. one-quarter inch in diameter were then drilled in the shaft at either side of the pulley and in line, and a 3/16 inch strip of steel placed between the two halves of the pulley, this being the available space after the clamp bolts were tightened. On either end of this strip was a short tit about ⅜ inch long, that entered the holes drilled in the shaft. The clamp bolts were used as a backing to support the steel strip. This served the purpose for a short time but eventually the end tits were sheared off. The final and effective repair is shown in Fig. 5. Two collars B were provided, open on the side for placing over the shaft, and the gaps filled with the piece C, fitted with the tee slots D; the two parts secured by the bolt E. The steel strip A, located as in the previous case, entered a slot X milled in each collar. When in position the collars were secured to the shaft by the set screws F. A general view of the repair is shown at G.

Belts Require Proper Care

Few details in connection with manufacturing receive less considerate attention than that of the belting that transfers the power from the line shaft to the various machines. Many men think that all that is required is a tight belt and all their troubles are over. If the belt is slack, take a piece out and relace the belt. Very good, if this is done with a knowledge of the necessary requirements. Few men will deny the advantages accruing from a well spliced endless belt, but how many of such belts will one see in the average shop, apart



MAIN DRIVE WELL PROTECTED BY GUARD

from those used on the main drives. The general practice on the larger volume of belts used is to cut the belts to the desired length and join by means of lacing or other fasteners. Many types of fasteners are now in use and are giving very satisfactory results, but few will retain the all-round efficiency of the ordinary leather lace when the joint is well made. One great disadvantage of metal fasteners, particularly where shifting of the belt is to be made by hand, is the danger to the operator contingent to the loose end of wire or metal portion. However, where careful attention is paid to such joints they are very effective for continuous drives. Leather lacing, nevertheless, will doubtless continue to be the general practice for belt repairs, owing to its accepted simplicity and general convenience.

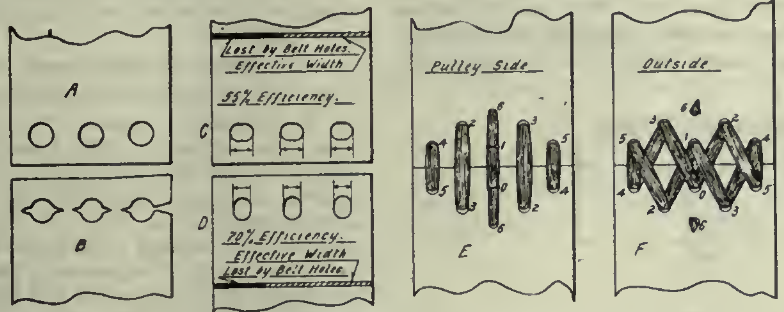


FIG. 6

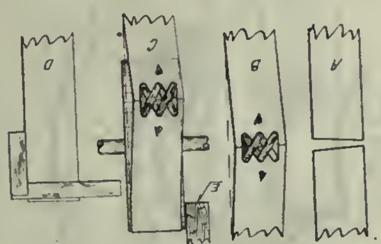


FIG. 7

Use Small Lace Holes

It must not be taken for granted, however, that all one has to do is to cut off a piece, punch a few holes and secure again with a lace, to obtain an effective drive. The fundamental details of a properly made joint may often seem of little import, but the subsequent operation of the belt may depend, very largely, on the consideration given to these apparently insignificant matters. When making a repair to a belt the beginner will usually make the lace holes of large size as indicated at A, Fig. 6. The inevitable consequence of such practice will be that shown below at B. With very few exceptions a belt will tear across the lace holes and seldom will fail in a direction parallel to the belt length. For this reason it is imperative that the amount of the leather cut out be kept as low as possible, consistent with the size of the belt and the thickness and width of the lace. Where it is necessary to enlarge the holes it should be done as shown at D and not as at C. This is obvious when comparing the resultant efficiency of the belt in each case. The heavy black line indicates the portion of the width cut away by the holes and the shaded line the effective section of the belt. With the same opening for the lace the efficiency of the lower method is 15 per cent. over that of the upper.

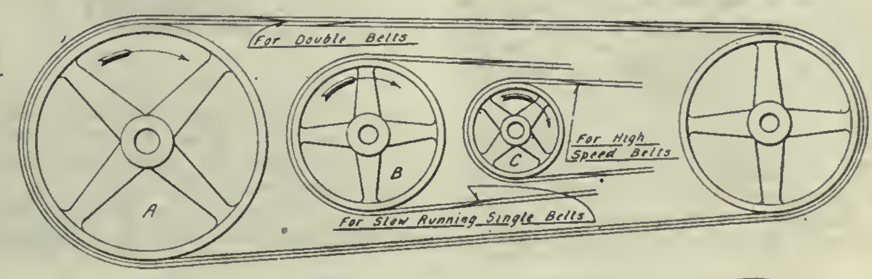
The best side of the belt to run upon the pulley appears to be a debatable question, as many favor the hair or smooth side, while others prefer the reverse. However, as the efficiency of a belt drive relies on the frictional contact between the surfaces it would seem practical that the smooth side would have the preference. Another factor in its favor is that of the recognized fact that the portion of the belt best suited for tensile strength is near the flesh or rough side, and the hardest side best adapted for the compression action; these features being quite evident when belts are operating on small pulleys.

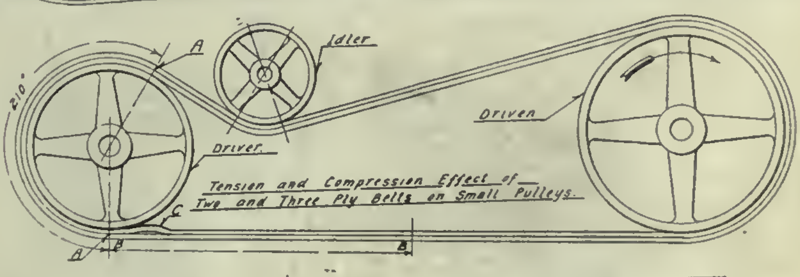
Making a Laced Joint

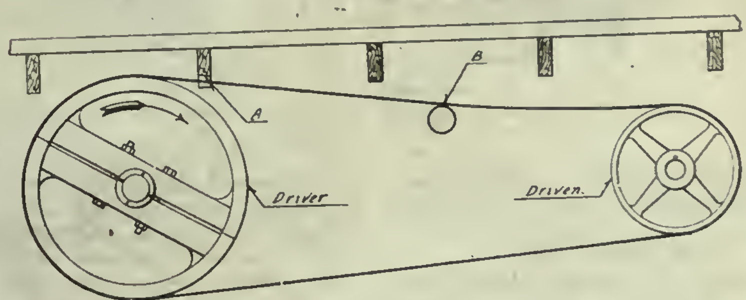
In making a joint it is advisable to use a thin lace in preference to a thick one. This coincides with what has been said on belt contact, as it is clear that the thicker a lace is the less will the contact be when the joint is passing around the pulley, and in addition the jar will be all the more pronounced. When making a joint the straight lacing should be made on the pulley side. Owing to the different widths of belts no fixed rule can be applied for lacing, but in general the method may be the same for every case. Holes should not be closer to the edge or end than one-half inch, with centre holes spaced accordingly. The best practice is to commence at the centre and work out and back on each side. As a guide the illustration at E and F is given. Starting at 0 and 1 the order is as follows: 2, 3, 4, 5, 4, 3, 2, 1 or 0, both sides of the centre being identical; the locking is performed by passing the free end through a small hole 6, and cutting a short slit to form a hook that will prevent the lace from coming out. This lock should be on the outside of the belt. After the joint is made it may be lightly hammered down with a wooden mallet.

Preparing Belt for Lacing

One of the essential factors of a belt joint is that the ends should be perfectly square with the run of the belt, to assure its smooth running. When cutting a belt the use of a try square, as shown at D, Fig. 7, is always advisable. Without such a tool the tendency is to make an angular cut as at A, so that when the joint is made it has the appearance as illustrated at B. When passing over a pulley the belt develops a tendency to oscillate, and such a condition is very much aggravated when the belt is running a little loose. To prevent it jumping off, a stick







FIGS. 8, 9 AND 10

is frequently secured to some rigid support and extended down at the side of the pulley, as at E. This, however, provides only a temporary remedy for a previous fault, as the weakest portion of the belt—the laced joint—is continually brought into violent contact with this "guide," and eventually the value

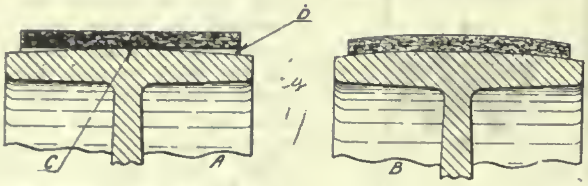


FIG. 11

of the joint is destroyed. Where guides are considered necessary—and they are only required to correct faulty installation or repair—they should take the form of rollers and not as rigid members; this would minimize but not entirely eliminate the source of trouble.

Direction of Travel

Another point that comes under discussion in connection with leather belts is that of the spliced joints, and their relation to the direction of travel. It is quite evident that the thin edge of the lap may show signs of parting after a period of service. For this reason some men contend that the belt should be run with the splice as shown at B, Fig. 8. On this principle the action of the pulley will aid in keeping the thin edge down to its place. On the other hand, some belt men say that the action of the air on the belt surface when in motion tends to lift the edge from its place. As this air action is greatest when the joint is passing around the pulley it would appear that the subject is open to discussion. However, as slow running belts are not subjected to excessive air action it might be said that the method shown at B would be best, and that at C best suited for high speed belts. Irrespective of the advantages claimed for either method, the entire question seems to be one of careful attention in the matter of repairs and maintenance so that faults may be remedied as soon as they are observed.

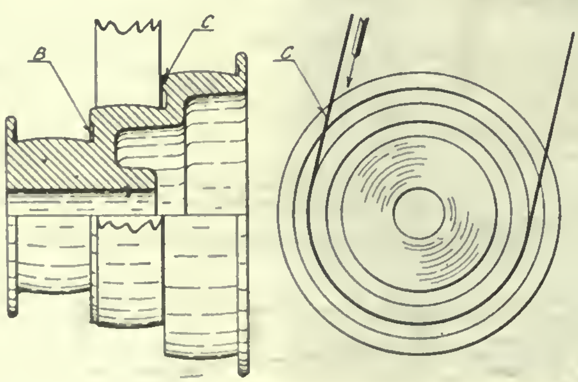


FIG. 12

Avoid Small Pulleys

In double or three ply belts these splices can be run to meet both conditions as shown at A. In the use of double or triple belts for heavy power drives, care should be taken to use pulleys as large as possible, consistent with speed requirements, as effective heavy drivers are not to impossible on pulleys of small diameter. This is quite clear when we consider the lack of flexibility of the heavier belts. Another argument against the use of small pulleys is the imperceptible cheeping action of the belt in making the round of the small pulley. It will be obvious to all that two opposite forces are at work when the belt is on the pulley—that of compression on the inner side and tension on the outside. These forces are neutralized between the curves, but immediately come into action again when the pulley is reached. For instance, suppose the length B-B, Fig. 9, to represent the length of the pulley circumference in contact with the belt. The length of both sides of the belt between B-B will be the same, but not so when this same portion is wrapped about the pulley, as at A-A. If the contraction of the inner side equals the expansion on the outside, the centre length will remain unchanged, but such is seldom the case, so that the tendency is usually to destroy the adhesion of the two layers as shown at C. For this reason too small pulleys should be avoided when using double or three ply belts.

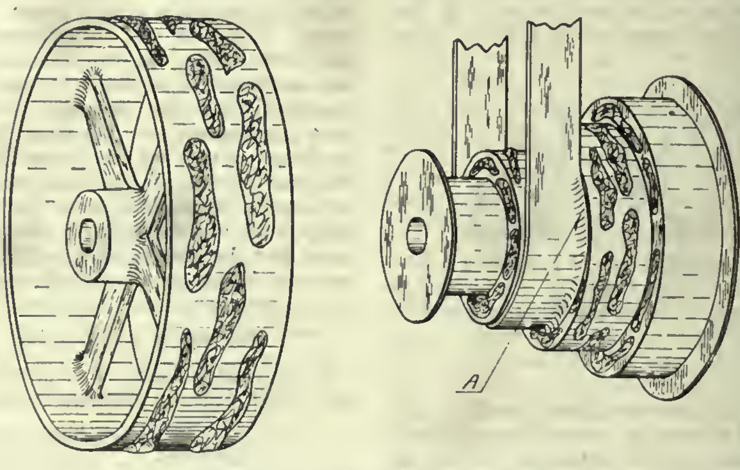


FIG. 13

Idlers as Tighteners

The use of idlers is often resorted to, but for the above reason, it is well to have these of fairly large diameter, especially where the idler contact is excessive, as the forces at work are directly opposed to those on the main pulleys, thus creating a destructive bending action in the fibres of the belt. For belt drives of this character it is advisable to maintain flexibility by means of some liquid preparation that will penetrate the fibres of the belt. When idlers are used they are invariably located close to the smaller pulley, so as to increase the arc of contact and likewise the driving power.

Keep Pull on Under Side

In the installation of horizontal or oblique drives it is always advisable to locate the shafting so that the pull on the belt will be on the lower side. This will bring any slack on the upper portion of the belt and the sag will add to the lap on the pulleys. To the average

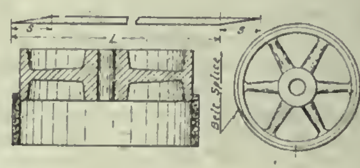
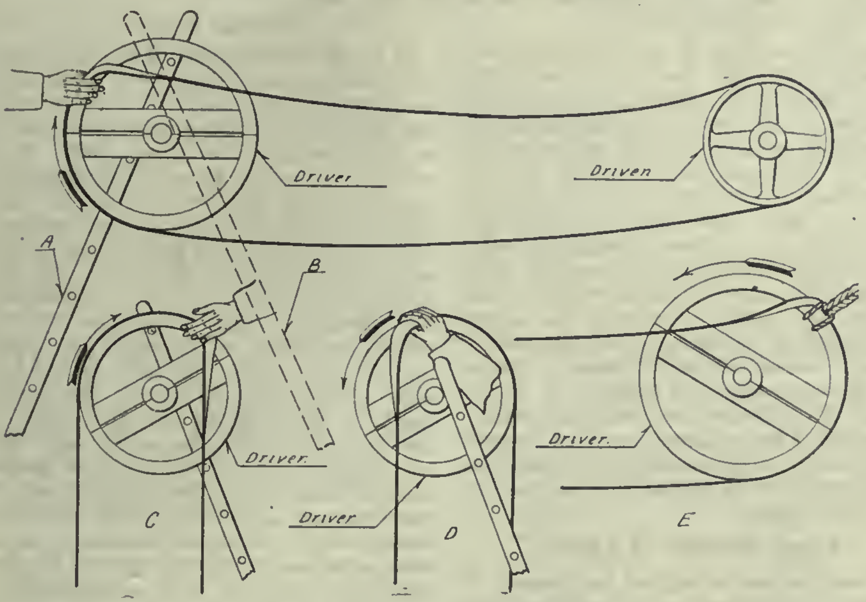


FIG. 14

man a tight belt is supposed to deliver the greatest power, and while in some respects this may be true, much of the power delivered is absorbed by the additional friction on the shaft bearings, so that the effective pull may be less than would have been the case with a little slacker belt. When the centre distance of a drive is relatively short it may be necessary to operate with a fairly tight belt, but in a long stretch a slack belt will give equal, if not better service than a belt that has excessive initial tension.

Have Plenty of Clearance

In many shops particularly those with low ceilings, the shafting may be placed in such a position that belts on large pulleys have very little clearance; in some instances it is necessary to cut a piece out of a beam or joist to allow the belt to operate. Frequently, this cutting is just sufficient to clear the belt, as



shown at A in Fig. 10. When the drive is one of a fairly steady or uniform load this may be ample, but if the load on the belt shows a tendency to fluctuate it is more than likely that the belt will flop up and down, invariably resulting in the belt striking the joist. Such action is very detrimental to the life of the belt and especially the lace at the joint, as the rubbing will soon effect its destruction and repairs are required. This also applies to other possible points of interference, as pipes or rods passing either above or below the belt, as shown at B. Where points of interference are a source of annoyance, facilities should be provided to minimize the trouble, such as the giving of greater clearance, or the placing of rollers to prevent excessive wear on the belt or laces.

Crowning of Pulleys Important

Steady running of belt is essential to effective transmission. For continuous drives, belts are generally run on pulleys that are very little wider than the belt, and to maintain its position in the centre, the pulleys are invariably crowned. This crowning usually consists of two straight tapers meeting at the centre of the pulley face. The amount of the taper varies from ⅛ inch to ¼ inch per foot; that is, a pulley 12 inches wide would be about 1-16 inch larger in diameter in the centre than it would be at either edge. In a straight taper crown, however, it will be seen that the apex C, Fig. 11, forms a definite or pronounced breaking point; nothing very serious possibly, but with a tendency, especially in new and heavy belts, to provide an air space at the edges D. A better plan of pulley crowning is that shown at B, where the surface forms an arc; this method equalizes the bending stresses throughout the width of the belt and makes the surface contact more uniform.

Careful Use of Belt Dressing

To increase the driving power of a belt, or rather to increase the pull, the use of belt dressing is very frequently adopted, and when judiciously applied such dressing may add materially to the effective operation of the belt, but where careless or thoughtless application is made, the practice may not only prove inefficient but very destructive to the belt. The driving power of a belt depends upon its flexibility and adhesive qualities, therefore the object of a belt dressing must be such as to retain these essential features. The adhesive action may be increased by careful application of belt dressing, but pliability can only be attained by a liquid or semi-liquid preparation that will penetrate the pores of the belt. When properly used a surface dressing will very often pull one out of a hole, but if constant applications are required to maintain the "pull," steps should be immediately taken to eliminate this apparent necessity, which is generally nothing but neglect in maintaining the belts or pulleys in good working conditions.

Destructive Practice

Where the surface dressing—or as it is often called, the "belt stick"—is freely used, it is not uncommon to see pulleys in the condition shown in Fig. 12, with large patches of the dressing clinging to the face. As said before a belt derives its power from frictional contact with the pulleys and while the pull from a well "dressed" belt may seem better, the general efficiency has not been increased. This may be made more clear when one realizes the air pockets that must be formed between the patches on the pulley surface shown in Fig. 12. To this must be added the pull required when the belt is leaving the pulley. A stamp may be easily placed on an envelope but some action is required in its removal. At your next opportunity notice a drive of this description and listen to the noise when starting or stopping. Just like pulling a porous plaster from your back.

However, where the excessive and needless use of belt dressing is more pronounced is on cone pulleys, where belts are required to be changed from one speed to another. The action of the latter is very similar to that of the straight pulley, but where the greatest trouble is caused is on the flange or shoulder. The accumulation of the dressing at this portion soon attracts the edges of the belt, with the result that it shows a marked tendency to climb to the next higher step, and very often succeeds, the inevitable consequence being a broken belt or lace, generally the latter. At other times the belt may climb, but instead of taking the next step will flop or twist completely over, once or perhaps twice. The writer has seen this happen on several occasions. These conditions should not be allowed to continue, and pulleys should be scraped clean as soon as possible. Even without the presence of dressing, belts on cone pulleys may often show an inclination to climb, due to faulty belt or pulley alignment. To assist in the proper running of the belt the flanges or shoulders should be undercut as shown in Fig. 13 at B. This provides a point of contact for the belt at C, the edge being kept clear of the flange throughout the entire wrap of the pulley.

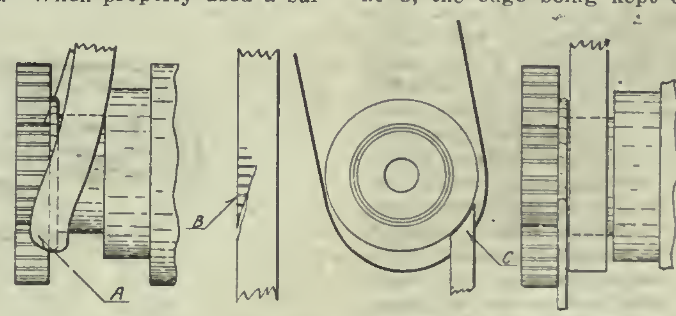


FIG. 16

Covering a Pulley With Leather

Many men resort to the practice of covering pulleys with leather to increase the adhesive power of the belt. When doing this the method generally adopted is to form an endless belt by means of splicing. First cut a piece of belting the required width to a length L, equal to about ⅛ inch per foot less than the circumference of the pulley; connect the splice in the usual manner, and when set, place the ring over the pulley, starting it evenly all round. Coat both the inner surface of the belt and the outer face of the pulley with hot glue, then take the pulley up by the spokes and carefully work the leather ring into place by

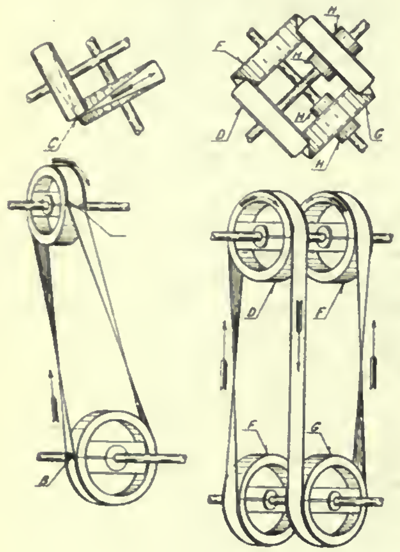


FIG. 17

bumping the edge on the floor or surface plate. Do this gradually to avoid kinking the leather, and quickly to prevent the glue from premature setting. If deemed advisable, a few copper rivets may be used.

Faulty Use of Nails

A leather-covered wooden pulley that came to the notice of the writer some few years ago was quite interesting and bears description. This pulley was located on the extreme end of a line shaft and was utilized to drive the countershaft of a buffing machine situated on the floor above. The buffer was subjected to very heavy service, frequently almost stopping at times, causing the belts to slip. Upon one occasion the writer was called upon to repair the main drive belt. Upon investigation it was found that the main drive was in a very dark storage room and the belt could only be seen by means of a special light taken to the ceiling. As stated, the pulley was found to be covered with leather, but a glance at the belt showed a strip right through the center on the inner side, that was in a deplorable state. Looking to the pulley for a cause it was discovered that the leather covering had been put on with nails, and several of these were protruding from ⅛ to ¼ of an inch. In this particular instance the nails were removed and replaced by fine wood screws, which proved successful. Probably the man that first covered this pulley thought that the belt would do its own driving.

Throwing Belts on Pulleys

A feature of factory operation that involves considerable risk to the workman, yet one that will likely never be discontinued, is that of throwing belts off and on the pulleys while the same are in motion. If shafting had to be stopped or even slowed down every time a belt required to be placed on or removed from a pulley, the suspension of production would be almost prohibitive, therefore the danger incidental to the maintenance of belts will always be with us. For this reason we should adopt the safest means of carrying out the work.

In the throwing off of a belt the risk is lessened by the fact that the belt comes off of its own accord in the greater number of cases, owing to slackness, poor alignment, broken lace, or one of many causes. When a belt requires to be thrown off a suitable stick is invariably used, but care must be exercised in its manipulation. Pressure should be applied at the leading side of the belt, that is, the side that is passing "on" to the pulley, and it should be seen that sufficient space is available at the side of the pulley to take the belt without it interfering with adjoining pulleys or couplings. If belts are thrown off regularly, other than for repairs, provision should be made to carry the weight of the belt so that it will not rest on the constantly-revolving shaft.

Proper Position of Ladder

When placing a belt on the pulleys it should first be located on the "dead" or driven pulley, as shown in Fig. 15, the actual running on of the belt being done on the driving pulley. As the latter is usually on the main shaft, in the majority of cases a ladder is necessary, and in placing the ladder, care should be taken to locate it on the outside of the drive, as shown at A. With the exception of special cases, where the drive shaft is located along a wall, the ladder should never be placed in the position B, and when such is absolutely necessary the shaft should be stopped and the belt run on at a very slow starting speed.

When standing on a ladder for this work the body should not be in a strained position, and one hand should be placed on a fixed object for support. For the lighter sizes of belts it is seldom that the speed of the driving shaft is reduced, as the knack is soon acquired of running the belt on. On the heavier belts the work is more difficult, but dexterity is attained with practice. When the belts are very heavy or extra tight, or with a load on the belt, "snapping on" is not so easy, and slipping of the belt is often necessary, while speed is accelerating. Under these conditions, however, care must be taken that the belt does not run off the driven pulley. On narrow pulleys there is always the possibility of the belt jumping off on the opposite side. Where possible, a good method is to place the ladder close to and on the opposite side, as at A, so that the lower edge bears against the pulley and acts as a guide for the belt.

Vertical Drives

If the belt is too tight or too heavy for the hand method, that shown at E may be adopted. By means of a light rope the belt is locked to the pulley and drawn on by slowly revolving the shaft. For vertical drives the same precautions are required. The correct method is that shown at C, where the belt is gathered up and placed on the far side of the pulley and drawn around to the near side, the ladder being placed as shown. A dangerous practice is that illustrated at D, where the belt is placed at the near side and followed on by the hand to the far side. This brings the arm in close proximity to the shaft at the final jerk of the belt as it takes the pulley, with the accompanying risk. When it is necessary to place the ladder in this position the workman should stand well up on the ladder, and it is also advisable to slow down the speed of the shaft. In the handling of belts, due consideration should be given to the surrounding conditions and at all times lean to the side of "Safety First."

Lathe Belt in Back Gear

A not uncommon occurrence in the operation of a lathe where the workman is not conversant with the proper knack, is that of the lathe drive belt jumping over the back cone flange and getting caught in the teeth of the gears, as indicated at A, Fig. 16. After this has happened the belt will have an appearance something like that at B. Where there is a danger of a belt running into gear trains, guards should be placed in suitable positions to protect the belt, as nothing will destroy a belt quicker than mangling it in the teeth of gears. For protecting a lathe belt a simple guard made of sheet steel, proves very efficient.

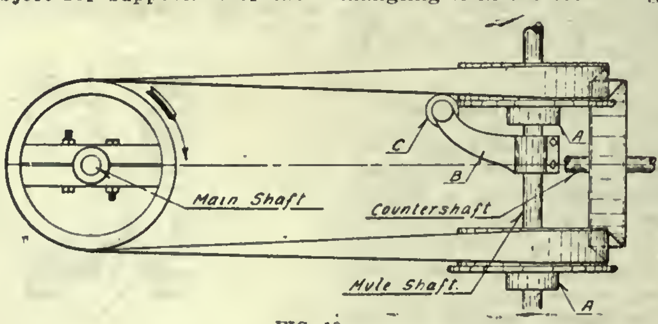


FIG. 18

Installing a Quarter Turn Drive

Drives other than those connecting parallel shafts are occasionally required, and local conditions must govern their installation, as a specific method is generally necessary for each individual installation. The most common is that of the quarter turn drive, and it may be accomplished in a variety of ways. The simplest form is that illustrated at the left of Fig. 17, where the shafts are placed at right angles, with the pulleys properly lined. The fundamental requirements in a drive of this character is that the points A, B, where the belt leaves the pulley, will be on the same vertical line as indicated at C. This is essential, otherwise the belt will not remain on the pulleys without the use of guides. One great objection to the two-pulley quarter turn drive is the fibre stress resulting in the angle of the belt in leaving the pulley. This fault is less pronounced if the shaft centers are relatively far apart.

A better form of quarter turn drive, but one that requires four pulleys and about twice as much belt, is shown to the right of Fig. 17. In this case one of the pulleys on each shaft must necessarily be a loose pulley, running in the opposite direction to its mate and kept in alignment by the collars H. The unavoidable quarter twist is required in the belt, but the fibre strains are less pronounced. With this method the belt can be run in either direction, whereas that shown at the left can only be run in the direction indicated by the arrows.

The Mule Drive

Another drive that is occasionally used is that illustrated in Fig. 18. This is known as the mule drive and is adopted where a machine is to be operated at right angles to the line shaft and where a quarter turn drive is not permissible. In the mule drive the connected shafts usually lie in the same horizontal plane, invariably at right angles, where the prolongation of the counter shaft would intersect the main shaft. The intermediate pulleys revolve in a horizontal direction on a vertical shaft. When it is desired to run the belt in either direction it is advisable to have the two main pulleys of the same diameter. Collars are necessary on the vertical shaft to support the pulleys. One bad feature in a mule drive, where the load is a fluctuating one, is the tendency of the belt to run off the mule on the slack side. It is preferable to have the pull come in the lower side, but in either case the slack side should be provided with a guide pulley C, carried in a bracket B fixed to the mule shaft. This will aid in supporting the belt when the load is on the machine.

SHIPBUILDING FIGURES

In the shipbuilding return issued last week by the Secretary to the Admiralty, the output of merchant tonnage in the United Kingdom and Allied and neutral countries during the years 1915, 1916, 1917, and the quarters ended March 31, June 30, and Sept. 30, 1918, was set out as follows:

Period.	United Kingdom. Gross Tons.	Allied and Neutral. Gross Tons.	World. Gross Tons.
1915......	650,919	551,081	1,202,000
1916......	541,552	1,146,448	1,688,000
1917......	1,163,474	1,774,312	2,937,786
1918			
1st Quarter.	320,280	550,037	870,317
2nd Quarter	442,966	800,308	1,243,274
3rd Quarter	411,395	*972,735	1,384,130

*Provisional figures.

The output for the world during the last quarter exceeded the losses from all causes by nearly half a million tons. The United Kingdom monthly figures were set out as below:

	Completions. 1917. Gross Tons.	Completions. 1918. Gross Tons.
January	48,089	58,568
February	79,451	100,038
March	118,699	161,674
April	69,711	111,533
May	69,773	197,274
June	109,847	134,159
July	83,073	141,948
August	102,060	124,675
September	63,150	144,772
October	148,309	136,100
Total, 10 months to Oct. 31, 1917....		892,162
Total, 12 months to Oct. 31, 1917....		1,045,036
Total, 10 months to Oct. 31, 1918....		1,310,741
Total, 12 months to Oct. 31, 1918....		1,582,053

As will be seen, the United Kingdom output for the three months ended Sept. 30 was 411,395 gross tons, a decrease of 31,571 gross tons as compared with the total for the second quarter. Allied and neutral countries produced, however, 972,735 gross tons (provisional figures) compared with 800,308 in the previous quarter. The output for the world was 1,384,130 gross tons—the highest record this year. The new merchant ship construction in the United Kingdom in October shows a falling off as compared with September of 8,672 gross tons, and is 12,209 gross tons less than the production of October, 1917. The total for 12 months to Oct. 31 last is 1,582,053, as against 1,045,036 for the similar period ended Oct. 31, 1917.

BLAST FURNACE BLOWER

In a blast furnace blowing set recently constructed by the British Thomson-Houston Company, of Rugby, the motive power for the blower, which is of their standard two-stage design with balanced impellers needing no balancing devices for end-thrust, is furnished normally by a synchronous motor running at 3,000 r.p.m.; but to guard against interruption of the blast through failure of the supply current or breakdown of the motor an alternative means of driving is provided in the shape of a Curtis steam turbine mounted on the same bedplate. This arrangement involves the insertion of clutches between the blower and the motor on one side and the turbine on the other, and the conditions laid down by the purchasers required the clutches so designed as to disengage the motor and engage the turbine automatically, in the absence of attendants, while the blower is running. In bringing the set up to speed the motor is started as a squirrel-cage induction motor, the clutch between it and the blower engaging as soon as its rotor begins to rèvolve. When the motor reaches practically synchronous speed, it is paralleled by closing the field switch of the motor rotor circuit, and it then works as a synchronous motor, at the same time acting as a power-factor adjustment on the 3,000 volt 50 cycle supply. On the steam supply main of the turbine there is a balanced starting valve which is kept closed by the delivery air pressure of the blower and the turbine is thus held out of action. But if the motor for any reason ceases to drive, the speed of the blower falls, the air delivery pressure is reduced, the starting valve of the turbine opens, the clutch between the turbine and blower shafts engages itself as soon as they reach the same speed, and the blower is driven by the turbine, the motor clutch automatically disengaging itself. A small drop in the air pressure suffices to open the steam valve of the turbine and the change-over takes place without shock; in fact, it is said to be almost impossible to detect the moment of engagement, although the speeding up of the turbine shaft and the slowing of the blower shaft are both extremely rapid. It is suggested that the type of clutch designed for this blowing set should find application, for example, under conditions where it is essential to maintain continuity of circulating water supply to the condensers of large turbo-generators, or where with motor-driven auxiliaries failure of current supply to the motors might cause serious temporary shut-down. The circulating pump would be provided with both a motor and a turbine, connected to it through clutches, and the turbine would be automatically started, when required, by means of a valve controlled by the pressure of the water delivered to the condenser.

TWO-CYCLE PARAFFIN ENGINE

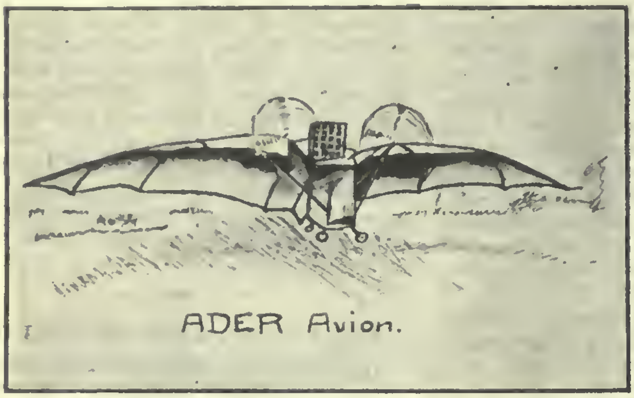
In accordance with the requirements of the Government Department, by which it was ordered, a 50-h.p. two-cycle internal combustion engine made at Eccles, Manchester, by the Record Engineering Company, of Donington House, Norfolk Street, W.C.2, was recently subjected to an endurance test of five days. During that time it ran continuously night and day at full load under paraffin, without attention or adjustment of any kind beyond the usual filling up of the fuel tanks and the supply of lubricating oil. None of the plugs were changed, and when the engine, which is of the V type, with four cylinders and two cranks, giving four impulses per revolution, was dismantled at the end of the test, it is stated that no appreciable signs of wear were visible, and that the cylinders were practically free from deposit. In the design adopted by the company, the two to one gears, with the camshafts, cams, tappets, and poppets found in the ordinary four-cycle engine, are eliminated and are replaced by a simple piston valve generally for each pair of cylinders, worked by an eccentric on the main shaft. As the valve merely controls the distribution of gaseous fuel to the pump cylinders it is not subject to a pressure exceeding a few pounds per sq. in., nor to the high temperatures of the working cylinders. The crank case is used only as a reservoir for lubricating oil and not for handling the fuel mixture, so that the deposition of carbon and soot on the bearing is avoided, as also is the mixture of fuel oil with the lubricating oil. As the cylinder heads are made loose, both piston tops and combustion chambers can be cleaned without dismantling.

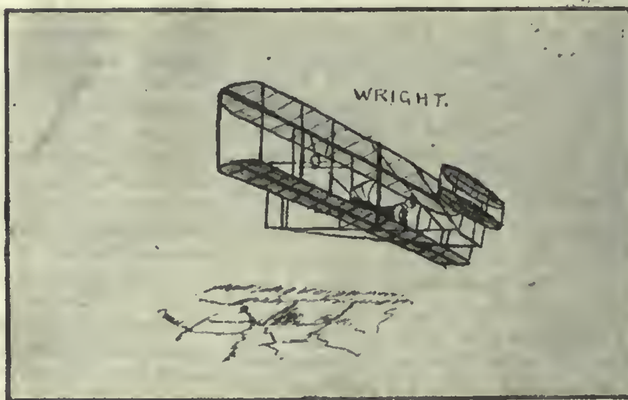
There's Nothing Impossible About Flying Now

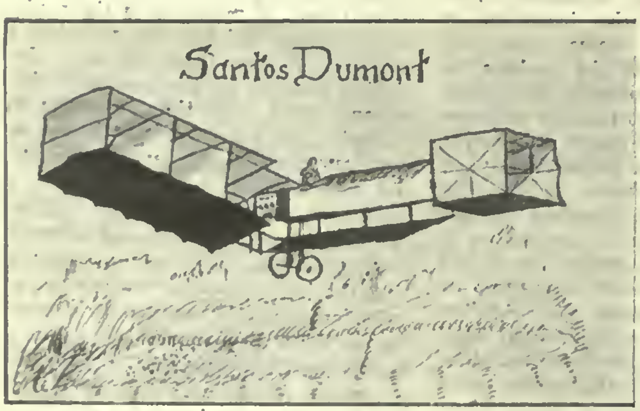
The Growth of Aviation Has Been Steady, But There Have Been Many Obstacles in the Way—A Resume of the Various Types of Machines Used in the Development of Flying From Its Infancy

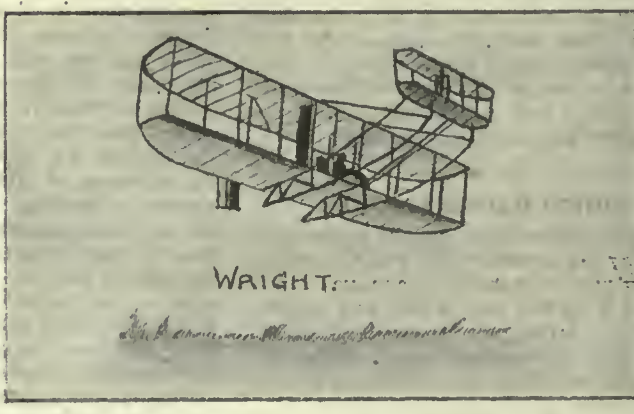
Written for Canadian Machinery by "ENERGY"

IT would be absurd for anyone to attempt to give a complete history of aviation. Is there one amongst us who could scour the world and find out every man who has experimented in aviation? There are, doubtless, thousands of unknown and unsung heroes who have passed into oblivion with their first attempts at flying and who, if the fates had allowed a second choice, would probably have turned the path of aviation into a totally different direction. The art of flying is now an ordinary accomplishment and within the reach of any sensible and average man of modern education. But it must not be thought by anyone that flying is of easy accomplishment. Just as there are drivers of automobiles who know nothing of their machines, beyond steering it along the roads, starting and stopping it, so there are pilots who can fly and fly only. Beyond this point they are useless. It is not so much to these men that the success of aviation is due. It is to our pioneers, such as Wright, Santos Dumont, Voisin, Farman, Curtis, Latham, Grahame-White, Cody, and scores of others that we owe the foundation of this new mode of transit. But it is not my object to dwell on flying itself, but rather to give a brief description of the evolution of our modern masters of the air.





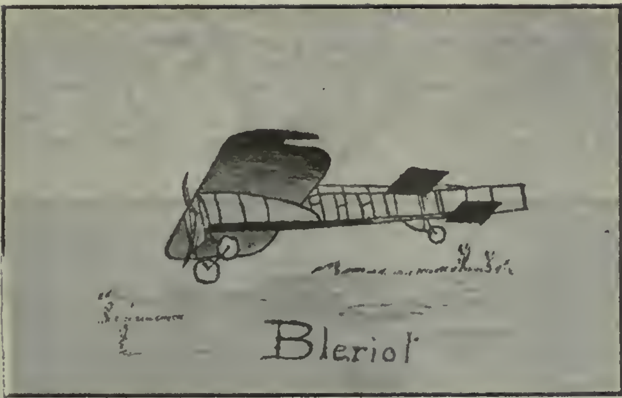




Started Twenty Years Ago.

The aeroplane is not by any means a very new thing, as we have records of flights being made over twenty years ago. In fact our very first authentic record of a flight was of that made in 1897, in an "Ader Avion" machine. It will be seen that efforts were made that the lines of this machine should resemble those of a huge bat. As one glances at the design of this early machine and compares it with the gracefulness of our latest aeroplanes, can one fail to recognize the immensity of the strides aviation has taken? Undoubtedly the war has hastened this perfection, though cynical people may ask why it has taken so many years to bring it to this state of perfection. My answer to them would be, that Rome was not built in a day, but only by ceaseless and untiring effort. The lack of interest and support on the part of the public greatly cramped our pioneers in the early stages. Now that this interest has been fully aroused aviation can go forward and who can forecast the climax of this latest science which is almost daily bringing forward some new discovery?

The world has much to be thankful for, for such experiments as were carried out in 1906-7-8 on Santos Dumont, Wright Bros., Voisin, Henri Farman, A. V. Roe (Avro), and Bleriot types of machines, which to our more trained eye look very crude and almost incapable of performing the wonders with which they are credited.

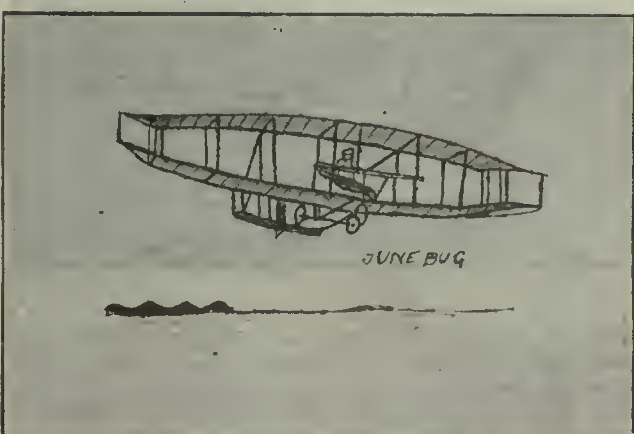


The Wright Bros.' First Machines

Taking a glance at the machine built by Wright Bros. in 1903, on which they made their first power flight, one can almost imagine the sensations the pilot must have felt as he glided through the air in his prone position and we cannot help feeling grateful for such a pioneer. I myself have descended in more than one steep nose-dive and retained a sitting posture, but what my sensations would have been whilst lying on my stomach with my head descending to the ground at an alarming rate I can only conjecture, but it would, I assure you, be a most uncomfortable feeling and require no ordinary amount of nerve. The Henri Farman was the first aeroplane to be used extensively, whilst the Avro was the first heavier than air flying machine built by British brains and labor to be successful. In 1907, the Wright Bros. modified their 1903 machine and fitted it with a 40 h.p. motor. On this machine much of the first real flying was done. The next two years saw some rapid advances made, because it was at this period popular interest had been aroused, the ever sceptical public being at last convinced that there were possibilities, money was advanced, competitions opened, trophies offered, and schools were formed to promote and develop this new idea, which was still thought by a great number of people to be a fool's pastime and a waste of money.

A Prize for Flying a Mile

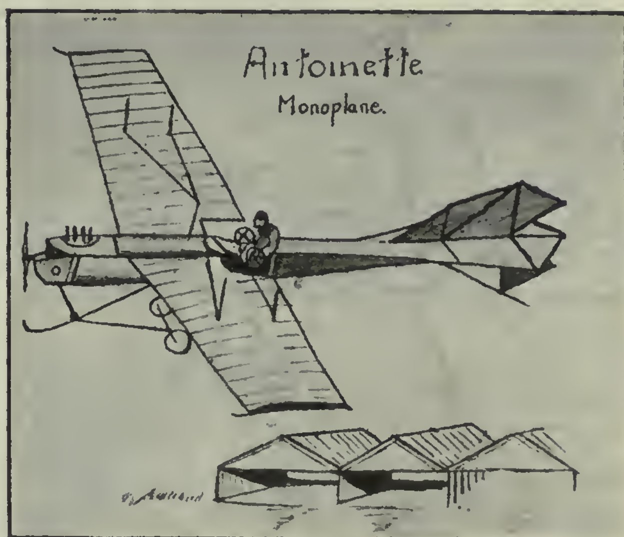
In 1909 we had the semi-Wright biplane, built by Short's, fitted only with a 35 h.p. engine on which Mr. Moore-Brabazon won the Daily *Mail* £1,000 prize for the first successful aviator to cover a mile circuit on a British aeroplane. (Think of it, one mile! and to-day we laugh at flying hundreds. Many of our aviators to-day would be rich beyonds the dreams of avarice had they but one dollar for every mile they had flown.) Simultaneous with this feat we had a production (which was the co-operation of Glen Curtis, Dr. Graham Bell and J. A. D. McCurdy),



a machine known as the June Bug. In the same year they produced a Box-type machine which won the Gordon-Bennett race at Rheims. It was about this time that the Antinette monoplane appeared. It was a machine of this type that the late M. Latham made his first attempt to fly the English Channel. It was in these years that meets were held at Doncaster and Blackpool, England, and the author well remembers the gracefulness of the Antoinette as she conquered the air and many were the compliments heaped on this machine. This type became extinct about 1911. It was at this stage in the history of aviation that the first German to fly, Hans Grade, appeared in his early struggles on a Demoiselle type of machine, a machine after the style used by Santos Dumont, bamboo being used very largely in the construction of it. A notable machine around this period was the Brequet, carrying as many as eight passengers. It was on a later design of this type that the late Mr. Moorhouse (who has since won immortality and the V.C. in this war) flew the English Channel with Mrs. Moorhouse and Mr. Ledeboer as passengers.

Aviation and the World War

From this time on, aviation has slowly, but surely progressed and at the sound of battle, interest grew apace. What laughter there was when our little air fleet sailed away in the skies to France. People, uninitiated, scoffed and jeered at these frail and puny creatures going



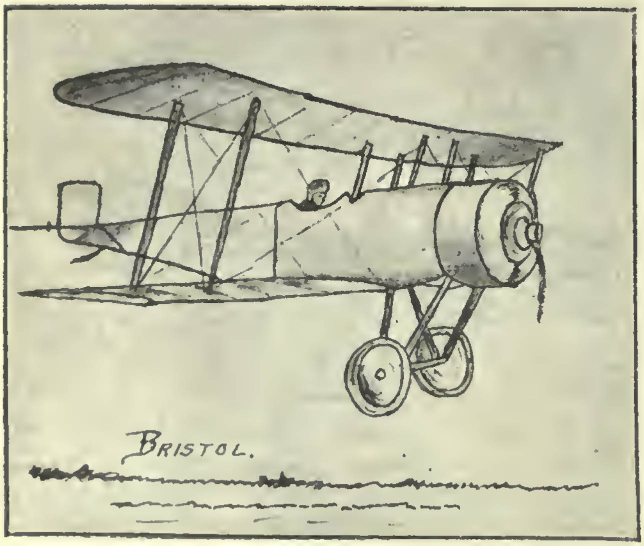
into the stern business of war. But with what success have these earlier achievements been endowed. As we have followed the history of the Great War, so we have been led to see the vast developments that have taken place in aviation. From frail-looking and undependable machines have grown mammoths of the air, giants of warfare, and the world has at last realized that aviation is an accomplished fact and not a fantasy of the brain. Oh! the wonders that have been performed and the help that has been given by the all-seeing eye of the observer as he scouted for the artillery or as he kept watch on the enemy's movements for our men in the trenches, and also the relief which the aeroplane has been able to bring to forces surounded by the enemy. It is not possible in such a short narrative to describe at all adequately the value and assistance which the aeroplane has rendered towards the attaining of the great victory. The multitudinous designs of machines which the war has brought forward are much too varied in type and too well known for me to make any attempt to describe their features. Fast scouts, fighters, heavy bombing machines, etc., are now handled with as great an ease as is the automobile. All this is the result of a few years' efforts, and now that victory is ours, why should not this great work go on?

The Power and Speeds

In discussing the evolution of the aeroplane it will perhaps be of interest to note the development which has taken place as regards the engines, the relative speeds of machines and the weights carried. The horse powers of engines have increased from 20 h.p. up to 800 h.p. and in one or two of our latest experimental planes as high as 1,000 h.p., the number of cylinders ranging from 2 to as many as 24 for one single engine. The Circuit of Britain was won on a machine fitted with a seven-cylinder engine of 50 h.p. In 1912, one of the naval machines, the Deferdussin, with a 70 h.p. Gnome, made a speed of 135 miles per hour. In June, 1913, a Pounier Pagney racing monoplane with a 160 h.p. Le Rhone engine competed in the Gordon Bennett race, doing approximately 130 miles per hour. We have machines now that can scale to a height of over 20,000 ft. in a remarkably short space of time, whereas, a few years ago, heights of less than half this distance remained unknown. Machines have risen as far as carrying passengers from the solo and dual machine to real passenger trains, carrying now as many as 30 and more people.

And What of the Future

It would be a stigma on the present generation were we to allow the progress of aviation to be hindered.

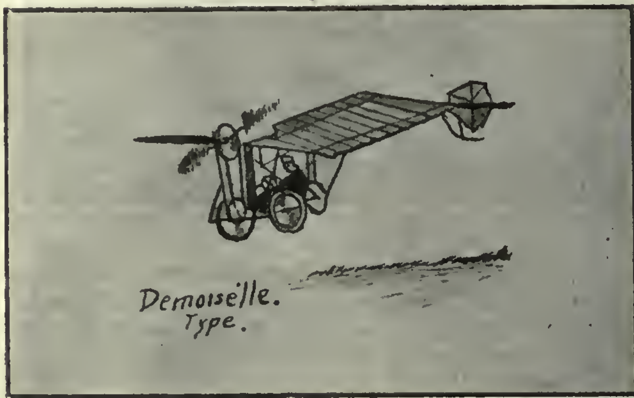


There are still yet fields to be conquered and objects to be attained, and now is the time for the rising generation to take up this new industry. Think of the field which is open to it here in this country. A country with thousands of miles unopened, uncultivated and uninhabited, because of the difficulties of transportation. Long, tedious train and seas voyages will fade into oblivion and short, pleasant aeroplane trips will put us in closer communication with our lands, our people and our friends in other countries. Then again, with the advance in aviation, would come its attendant success of commercial life. Factories, schools, aerodromes, repair shops and all the other accessories to flying would spring into being, bringing with them labor for thousands from the scientist down to the humblest laborer. Surely after all that has happened these past few years, aviation will not be allowed to remain stagnant. No, let not these pioneers (some of them dead) turn again and say that as a nation we lack enterprise, but let us carry forward the work so that nations may profit and humanity at large can derive those benefits which our pioneers intended we should reap.

WHAT CANADA HAS ACCOMPLISHED

IN the report issued by the Imperial War Cabinet for the year 1917, Canada's services to the Empire in the production of munitions was referred to as follows:

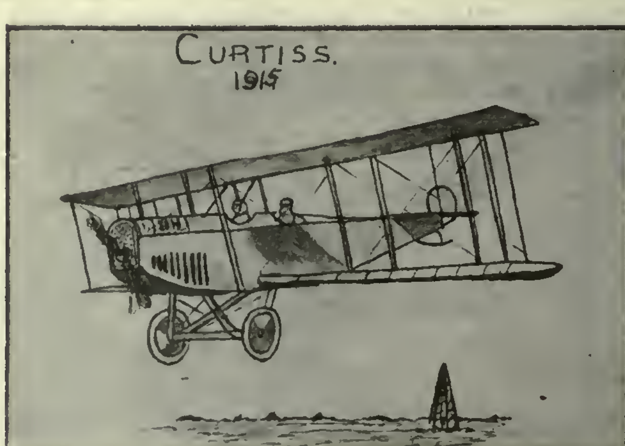
"Canada's contribution during the last year had been very striking. 15 per cent. of the total expenditure of



the Ministry of Munitions in the last six months of the year was incurred in that country. She has manufactured nearly every type of shell from the 18-pdr. to the 9.2". In the case of the 18-pdr., no less than 55 per cent. of the output of shrapnel shells in the last six months came from Canada, and most of these were complete rounds of ammunition which went direct to France. Canada also contributed 42 per cent. of the total 4.5 shells, 27 per cent. of the 6" shells, 20 per cent. of the 60-pdr. H.E. shells, 15 per cent. of the 8" and 16 per cent. of the 9.2". In addition, Canada has supplied shell forgings, ammunition components, propellants, acetone, T.N.T., aluminium, nickel, nickel matte, aeroplane parts, agricultural machinery and timber, besides quantities of railway materials, including no less than 450 miles of rails torn up from Canadian railways which were shipped direct to France."

The Right Kind of Steel

Experiments were conducted shortly after the outbreak of the war with steel made in Canada, with a view of securing something more nearly approaching an adequate supply of shrapnel. It is revealing no State secret to say that in those early days of the war the supply of this form of explosive on the Western front was



perilously inadequate. Basic steel, the only kind made extensively in Canada, was suitable, and it was in the month of December, 1914, four months after the outbreak of the war, that Canada made her first shipment. By the end of May, 1915, approximately four hundred establishments in Canada were engaged in production.

Recent Promotions in Grand Trunk Shops

R. J. Needham, Chief Engineer, G.T.R.

R. J. NEEDHAM, recently appointed to the position of chief mechanical and electrical engineer of the Grand Trunk, with headquarters at Montreal, was born on January 11, 1882, at London, Ontario, in which place he acquired his early education. After graduating from the London High School, he managed a plumbing and heating business for four years. In 1906 he entered McGill University as an undergraduate in applied science, specializing in electrical engineering, and graduated with the degree of B.Sc. in 1910. He was employed in the erection and testing department of the Connecticut Dynamo and Motor Works of New York, from May to October, 1907. In May of the following year he accepted a position as inspector of electric locomotives and operation for the Grand Trunk at St. Clair Tunnel. During the summer of 1909 he was employed by the New York Edison Co. in their testing laboratory at the Waterside Station No. 1 in New York City. During 1910-11 he was engaged by the Detroit Edison Co., first in construction work and afterwards as chief operator. From 1911-18 he held the position of electrical engineer with the Grand Trunk Railway, and in September, 1918, he was appointed to the dual position of chief mechanical and electrical engineer with the same company.

R. J. NEEDHAM

W. A. Booth, Chief Draughtsman G.T.R.

WILLIAM ALFRED BOOTH was promoted to the position of chief draughtsman of the Grand Trunk motive department on October 1, 1918, after serving in the capacity of assistant chief for the past ten years. Mr. Booth was born in Montreal and received his early training in the city schools under Prof. S. H. Parsons. Twenty-five years ago he started as junior draughtsman with the Grand Trunk at Montreal. During his early years with this company he attended classes under the jurisdiction of the Mechanics' Institute, and freehand classes under the Council of Arts and Manufacture of the Province of Quebec. For many years he was elevation draughtsman for the Grand Trunk. Mr. Booth is much interested in the welfare of the younger element and for some time has been instructor of apprentices on the subjects of geometry and mechanical drawing.

W. A. BOOTH

W. J. Hyman, Car Dept., G.T.R. Motive Power

W. J. HYMAN, who was recently appointed chief draughtsman of the car department of the Grand Trunk, with headquarters at Montreal, was born on Aug. 9th, 1882, at Radstock, Somersetshire, England. Following his public school education he served a six-year apprenticeship at car design and construction. In 1903 Mr. Hyman came to Canada and worked in the car department of the Grand Trunk until 1905, when he was transferred to the car department drawing office, acting in the capacity of draughtsman until 1913, when he was appointed to the position of assistant chief draughtsman. Mr. Hyman has always taken a great interest in the younger boy and was instrumental in organizing the car department apprentices' classes in 1911, with courses in mathematics and mechanical drawing, supervising these classes up to May, 1918, when the motive power and car department classes were merged into one. He was promoted to his present position on the 1st October of this year.

W. J. HYMAN

W. H. Hicks, Winnipeg

W. H. Hicks, 567 Banning Street, Winnipeg, has taken over the Canadian Sirocco line for Manitoba and Saskatchewan, also Western Ontario, including Port Arthur and Fort William. He will handle their regular lines of ventilating fans, steam traps, and high-speed vertical engines.

W. H HICKS, WINNIPEG

Quebec's annual production of pulp-wood exceeds 1,000,000 cords. Ontario comes next with about 800,000 cords.

It takes, approximately, 1½ cords of wood to make a ton of paper.

Spruce trees, best suited to the production of pulp, require from 100 to 150 years to arrive at maturity.

Forest fires are a source of great loss to the Canadian pulp and paper industry and eat up millions of cords of wood-pulp every years.

Where coal is used to generate power in the operation of paper mills it takes, approximately, a pound of coal to produce a pound of paper.

The average labor cost of producing a ton of paper has increased 75 per cent. in the period of 1912-1918.

More Efficient Methods Follow War Work

What Has Shell Making Meant to the Canadian Trade?—The Creation of the Special Machine—Standardization Means Much to the Factories and May Figure in Future Operations

By J. H. RODGERS, Associate Editor Canadian Machinery.

WITH the cessation of shell making, Canada brings to a close one of the most rapidly developed and most extensive industries ever engaged in by manufacturers in this country. The many plants involved in the production of the various types of munitions are not yet cold from the unprecedented activities of the past four years and it may be a little early to dwell on the possible development contingent on the experience acquired by those associated in this enterprise, but it is not beyond the pale of reasonable thought to anticipate remarkable changes in the post-war methods of manufacture, as a result of the practical knowledge thus attained. While we all recognize the regretable features of a war of the magnitude of the one just recently brought to a close, we cannot but realize that many lessons have been taught us from which we as a nation, and likewise the world at large, should ponder over and assimilate into our further efforts so as to assure a profitable period of continual prosperity in moral, social, commercial and industrial activity. It is more concerning the latter of these four with which the present article has to deal.

One of the outstanding features that has characterized the notable achievements of shell production was the high point of efficiency that had been attained during the past year of the work. When one looks back and recalls the early struggles in connection with the making of shells and the obstacles that had to be overcome during the incipient stages of the industry, it reflects great credit on those responsible for the progress that has been made in this important phase of war development. Before touching on the many changes that are likely to influence future manufacturing methods, it might be well to review some of the causes that were primarily responsible for this wonderful evolution. It must be remembered that very little was known about the manufacture of munitions in this country prior to the opening of hostilities in 1914; what small quantities had previously been produced being made in the arsenal at Quebec, and for this reason the Canadian manufacturers were dubious about undertaking a task about which they knew virtually nothing. However, despite the fact that little reliable information could be obtained respecting the existing methods of shell production, the urgency of the need was so imperative that little hesitation was shown once it was decided to undertake the work. One of the factors that prevented early efficiency in the production of shells was the general impression that the war would be a short one. With this in mind and the lack of knowledge then available regarding production on a basis it has since attained, the early practice of shell-making was naturally along the lines with which the engineers in this country were more or less familiar. With the thought of a short war before them, those firms that were acquiring machinery for the purpose of shell-making, did so with the intention of utilizing this equipment for subsequent operations in connection with their regular business. Under these conditions it will readily be seen that the bulk of the initial shell machinery was of the standard pattern, and minus the experience of systematic production, the tools ordered for future operations were also of standard design and construction, single purpose machines being a later development.

Early Difficulties

ANOTHER feature that had considerable bearing on the machines adopted was the belief that high-grade machine tools were the only kind suitable for the purpose, and that accurate adherence to specifications and dimensions was only possible with the best equipment. Had the war been of short duration it is safe to say that the evolution of shell-making would not have gone very far beyond the practice of 1914; but those pre-war methods of shell production are, and will likely remain, a matter of history. It was early in 1915—and after renewal orders had been placed for shrapnel—before the manufacturers here began to realize fully the magnitude of the task and the urgent necessity of accelerating production, not only on the shrapnel but on the heavier high explosive shells that were then required. The utter inability to obtain standard equipment at this time was, as then thought, the chief drawback to speedy production, and while this feature was a source of general annoyance at the time, it undoubtedly proved a boon in disguise. This factor of the early troubles of the Canadian manufacturer, together with the apparent impossibility to obtain definite data or information respecting the recognized methods of shell production, were the two outstanding causes that led to the development and adoption of the special equipment now used for this specific purpose

Creation of the Special Machine

THE industry had rapidly spread from coast to coast and within a very short time the majority of the metal working plants in the country were engaged, or contemplated engaging in the making of shells or some of the component parts. As said before, tools of a suitable character were very hard to obtain and many firms securing contracts often found that eight or ten months must elapse before they could secure machinery. This long delay was almost prohibitive and in order to meet the immediate demand for shells it became imperative to devise means whereby operations could be carried on, even though it be on greatly reduced scale. Little could be gained from the experience of others and, therefore, each individual plant organization had to rely on its own initiative and resources for the development of tools and attachments to supplement the existing equipment, or that otherwise available. The so-called scrap heap became a very valuable asset overnight, and many a machine was reclaimed and placed back into service for profitable work in connection with certain operations. The adoption of special attachments on many of these machines was the basis of a great number of the single purpose tools subsequently designed for many of the detail operations relative to the machining of the shells. From these impromptu devices have been evolved nearly all the special machines now recognized as the most efficient for the manufacture of munitions. It is perfectly safe to state that if the industry were to be renewed at a future date—and we trust this may never be—that machines acknowledged as standard tools would receive no consideration in regard to the actual work on the machining of the shell. A trip through the average shell plant a few months back would demonstrate to what extent the "standard" tool has been eliminated from this particular industry. Nine-tenths of the equipment—exclusive of that used in the tool making departments—is of a type suitable only for the operation for which it was originally designed.

The question has often been asked as to the future of these machines. The answer regarding the bulk of the "shell machinery" is—nothing but food for the cupola. This, however, does not apply to the single purpose machine in general, as experience has exemplified the great efficiency of this class of equipment for repetition and standardized production, where the same is carried on on an extensive scale.

One of the lessons that has been learned from this great industry is the possibilities of greater co-operation for a more systematic basis of manufacturing articles in large quantities. What has been achieved in time of war could well be accomplished in times of peace, providing the same spirit of co-ordination permeated the producers of material.

Routing of Work Essential

ONE of the essential factors of efficiency is the elimination of waste effort, and production engineers are ever striving to minimize this objectionable feature. One of the fundamental requirements of economic standardized production is the routing of the work during the process of manufacture. This question was given very little consideration during the incipient stages of munitions making, with the result that the handling of the shells from one machine to another was frequently more costly than the actual machining operations. Where machine shops already established took up the work of shell making it was often a difficult problem to utilize the available equipment to the best advantage, without re-arranging the entire layout, and not infrequently additional tools were located in a haphazard manner throughout the shop, with little thought to the sequence of operations, so that it was necessary to transfer the work back and forth during the process of manufacture. In shops where such conditions existed it was next to impossible to secure from the equipment the output which would have resulted from a better arrangement of the machine tools.

Where additions to existing factories were required, or where new plants were built, the routing of the work was given the first consideration, so that the machine installation was of such a character as to eliminate any unnecessary "backing up" of the work in its progress through the shop. What has been true in respect to shell making is equally true in almost any line of manufacture, and it is an essential fundamental that successful work of a repetition character cannot be carried on unless careful attention is given to this important problem of work routing, a factor that, in the past, has been very often sadly neglected.

The Shell Mechanic

ONE phase of recent activities that must not be overlooked as having a bearing on future enterprise, is the great number of men and women that have acquired, from their sojourn in the shell plants a certain percentage of mechanical skill and knowledge resulting from their continual operation of the different machines. It may be said that few of these men would be fitted to fill the position of a mechanic in ordinary industrial practice, but we must acknowledge that this is the day of specialists, and post-war manufacture will be developed along these lines more than ever they were in the past, and the experience they have gained during the past four years may well fit many of them for a position as a machine operator where considerable quantity of work is performed on a repetition basis. Then again, many of these men, who before the war were in positions where the remuneration was comparatively low in relation to their "war wages," may feel inclined to remain at a class of work assuring greater compensation. On the other hand, shell work on the whole has been a killing job, and many of those recently engaged in the industry may be only too pleased to return to their former occupations. It is quite certain, however, that very few will have acquired sufficient elementary mechanical knowledge or experience to assure for themselves a place in a plant where general all-round ability is essential, so that it is very unlikely that the engineering field will be seriously affected by the available supply of "shell mechanics." This, however, may be one of the problems of the reconstruction period.

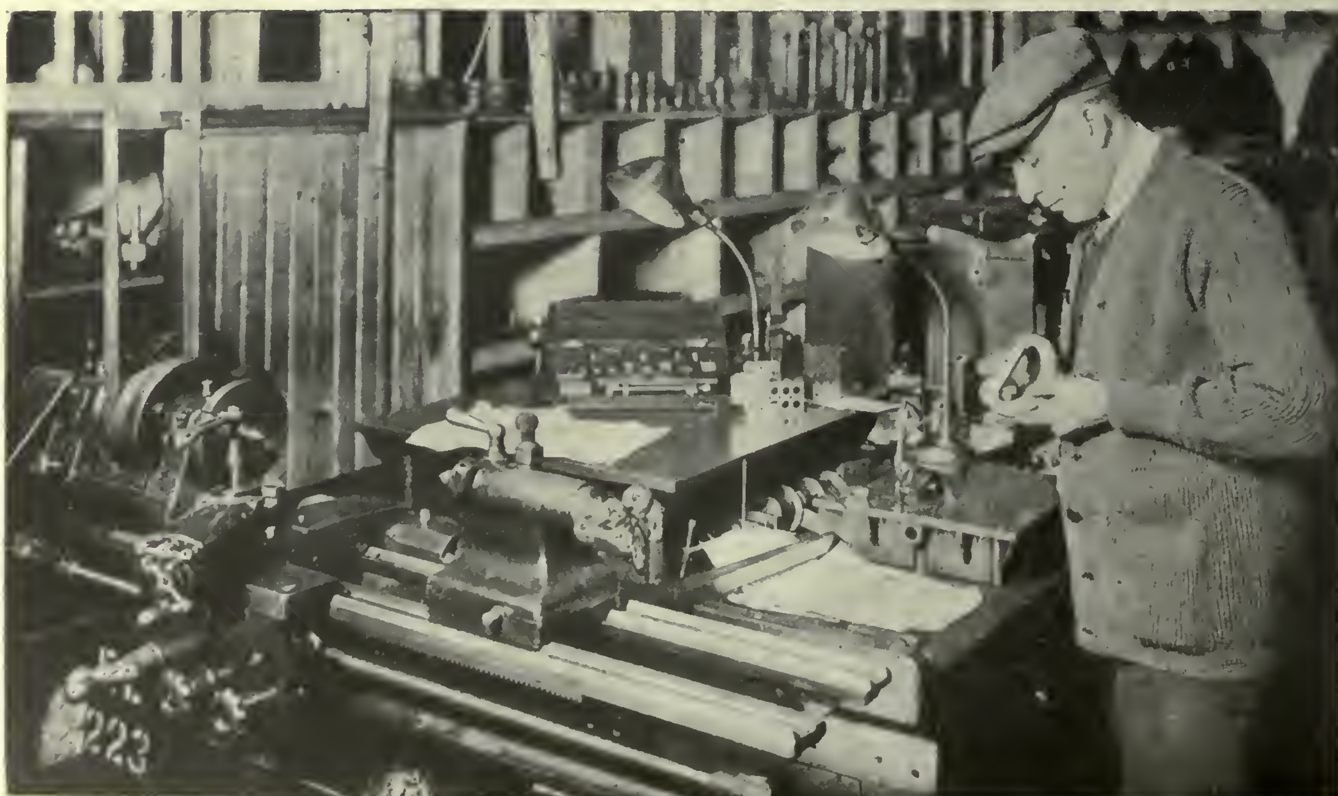
Progressive Inspection Very Important

ONE essential to the successful achievement of manufacturing where the work involves a number of different operations on one or more pieces. is that of progressive inspection. It was clearly demonstrated during the first year of the war that the only assurance of effective production was by a thorough inspection of the work at stated intervals during its semi-finished state. The importance of keeping within the specified limits of tolerance, both as regarded dimensions and weight, was not duly recognized by many of those pioneers engaged in the work, the consequences being that in many instances large quantities of finished and semi-finished shells were rejected by the Government inspectors. It was frequently the case for firms to have elaborate inspection of their own just prior to the work going to the Government cage, little previous attention being given to the checking of the work in its earlier stages. This invariably resulted in a large percentage of the work being returned for some slight alteration or correction. It was soon seen, therefore, that to minimize the factor of shell rejections it would be necessary to have a closer examination of the product after each operation, so that faulty work of the machine or the operator could be corrected immediately, thus avoiding the accumulation of spoiled work or the exaggeration of the defect on the following or subsequent operations. This method of inspection might be considered too costly for work other than munitions, but when the advantages are weighed against the disadvantages it will be found that the economic factor is in favor of its adoption.

Standardization Stimulated

IF one were to ask the question—what was the predominating feature of shell production? the answer would invariably be—standardization. In the past many firms have prided themselves on the standard character of their product, and in many respects have been able to substantiate the statement, but the mechanical industry as a unit has had little conception of what the term "standardization" actually meant. Here again the activities incidental to the prosecution of the war have taught us many lessons. No greater advancement has been made toward the zenith of standardized practice than the methods adopted for checking the dimensions on the shells and component parts. In ordinary industrial establishments the practice was localized almost entirely to the plant in which the product was made and afterwards assembled, so that little expense was entailed if some corrections were required. The great national industry recently engaged in, amply demonstrated the imperative necessity of working within certain specified limits of measurements, to assure undisputed accuracy of all dimensions, so that no difficulty would be encountered when assembling the various parts, irrespective of where these different pieces had been produced. A machined dimension at the Pacific must correspond with a similar dimension at the Atlantic coast, within the limit of tolerance, be this ⅛ of an inch or 1-10,000 of an inch, otherwise standardization or interchangeability becomes a negative quantity.

With the possible exception of a few tool or automobile manufacturers it is doubtful if more than 20 per cent. of Canadian metal industries had been accustomed to



WAR HAS DEVELOPED THE ART OF GAUGE MAKING TO A HIGH STATE OF PERFECTION.

working to the fine limits or low tolerances required in shell specifications. Yet to-day there are tens of thousands of men and women, who, before the war, did not know the difference between 1-32 and 1-1,000 of an inch, and are now capable of measuring limits of a few thousandths as easily as a carpenter measures a twelve-foot board with his two-foot folding rule. The reason is—the limit system. These same men and women may still be ignorant as to what an actual dimension is, but the fact remains that they have accomplished remarkable results due, not to their knowledge of fine measurements, but rather to their ability to use the gauges that are provided for the purpose.

Passing of the Spring Caliper

IT would be virtually impossible for a staff of experienced mechanics, working with the old style spring or friction joint calipers, or even with the standard micrometer, to maintain the speed and accuracy acquired by these "shell mechanics" with their limit gauges. Naturally the gauges required careful checking at intervals, but once set to the desired limits of "go" and "no go," the operator's only concern was to see that the limits were adhered to; it did not matter to him, or did he even know, probably, whether the size was an inch or a foot.

Standardization is a big problem, but the war has given a stimulus to its further adoption that will eventually eliminate the pre-war indifference so prevalent among many manufacturers. There is no reasonable argument why an inch should not be an inch, yet how many mechanics would produce the same size hole or plug if given the work to do? The feel or touch of no two men is exactly alike, therefore, the size would vary accordingly. With the limit system this would be avoided.

Importance of Proper Gauges

IT must not be supposed that the advantages of a limit system are confined to work where the tolerance is only a few thousandths or fraction thereof; the system may be applied economically to work where the tolerance is as high as 1-32 or 1-16 or even greater, the nature of the work and its intended purpose being the determining factors. Nor should the volume of the product prevent the adoption of a fixed standard, for with modification the practice is as economical in one line of manufacture as another. Some time ago the superintendent of a certain plant had six small intricate pieces to make, which, under ordinary conditions would have been performed in the usual manner of making each piece separate without gauges or jigs, using only the general tool-box outfit. The initial expense of making a jig and gauges necessary for the work consumed nearly all the profit that might have been made without them, but it was the policy of the shop to have fixtures and gauges made for everything where there was the least possibility of renewal orders. In this particular instance the initial six articles were supplemented by twelve others, so that with the facilities previously provided, the last twelve were turned out in one-quarter the time taken on the first six, and the entire eighteen were practically identical. As an economic feature alone, the question of standardization should receive the immediate attention of every manufacturer, for its early adoption means national as well as individual efficiency, two factors that are of imperative necessity in the present period of reconstruction and world competition.

Future Opportunities

FEW will deny that, before the war, the world at large was dependent—unconsciously perhaps—on Germany for certain classes of brains and materials. The experience so forcibly pressed home to us during the war period should not, however, permit of us again placing ourselves at the industrial, commercial or intellectual mercy of such a country as Germany, or in fact any other. Some may contend that this policy will be closely adhered to by the people of the Allied countries who have suffered so much from the depredations of the Huns, but with the patriotism gradually dying out, the commercial world will soon return to the monetary basis, so that the exclusion of German products must be solved by our own manufacturers in producing economically every type of goods that will clash with those of other countries.

The progress that has been made must not stop with the stoppage of the shell industry, rather should the experience be a stepping stone to still greater achievement. The revolutionary changes that have taken place in nearly all lines of manufacture will make it almost impossible to revert back to the old course of pre-war days. Industrial development, scientific and practical, has been of such a character that post-war activities will be conducted with a wider and more expert knowledge than ever before. The rapid advances that have been made in the manufacture of steel and the extensive experiments that have been carried out, will place this industry in a much superior position, and will form a basis for still further developments in this and allied industries.

Future of Machine Tools

THE vast amount of machine tools that have been utilized for the shell industry has frequently been used as an argument in favor of a period of depression in the machine tool activity. There is considerable divergence of opinion on this matter, and therefore, a prediction in either direction might be sadly amiss. Much will depend on the length of the period of post-war adjustment that must inevitably follow on the heels of a great war. It is quite reasonable to anticipate a brief spell of inactivity before reconstruction gets into full swing, but there is little to indicate that an indefinite space of time must elapse while these shell shops are unloading their equipment on a waiting market. These tools have been in constant use from 15 to 24 hours a day for from two to four years, and in the charge of men whose only thought was the machining of the shell, the care of the tool itself not coming within their line of vision. The specific design of the majority of these machines is the chief argument against their adaptability to ordinary commercial use. Where standard tools have been utilized for the purpose the nature of the work will naturally have deteriorated their value for general machine shop practice. It would therefore seem that shell machinery—apart from that used in the tool rooms, which has been operated by experienced mechanics—will not be a reactionary factor on machine tool activity. These special machines will, on the other hand, open the way for changes in the design of standard equipment that may eventually mean a period of increased prosperity for machine tool builders.

Experience in shell making has shown the possibility of improved methods in cutting and removing metal, which, under pre-war conditions, could not be met with the existing standard tools. Manufacturers, having seen the efficiency of changing machine design and construction will want the very best for the development of their future activities. This not only applies to Canadian industries but likewise to every country involved in the war, and to many of the so-called neutrals. The peoples of the world have been thrown into closer contact than ever before and greater all-round efficiency will be the natural consequence. Manufacturing will be the basis of this efficiency and therefore economic production will be the keystone of every country's development, so that everything detrimental to progressive activity will eventually be replaced by up-to-date methods and practice.

Canada's Part in Beating the Submarine Peril

Many Trades Are Called in When a Ship Contract is Secured For This Country.

Can Canada Go Ahead and Compete With British Owners When Cost is Taken Into Consideration?

By T. H. FENNER, Editor Marine Engineering

NOW that the tension is ended, and we have time to look back, Canada's effort in damming the drain on the Allies' shipping stands out as strong as that of any.

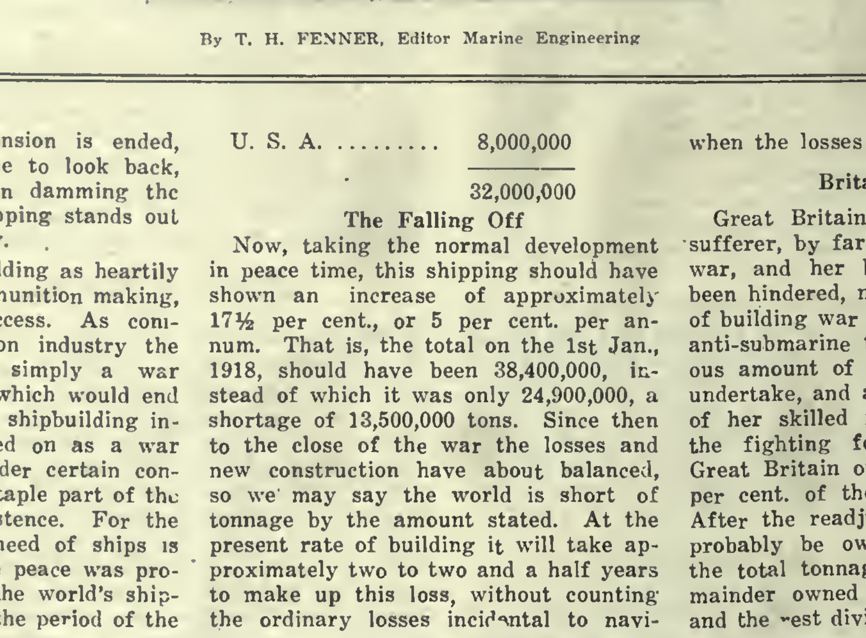
She went into shipbuilding as heartily as she entered into the munition making, and with as much success. As compared with the munition industry the latter was purely and simply a war measure, the utility of which would end with peace, whereas the shipbuilding industry, primarily entered on as a war measure, is capable, under certain conditions, of becoming a staple part of the country's industrial existence. For the immediate future, the need of ships is just as urgent as before peace was proclaimed. The state of the world's shipping before and during the period of the war were about as follows: On Aug. 4, 1914, the total tonnage of allied and neutral countries was approximately 42,000,000 tons. Up to January 1, 1918, the total losses by mine and submarine were 9,500,000 tons, and by other marine casualties, 1,275,000 tons. This gives a total loss of 10,775,000 tons. Deducting this from the total at Aug. 4, 1914, we have 31,225,000 tons of pre-war shipping afloat. To this must be added the ships constructed during the same period, which amount to 4,485,000 tons, making the total at Jan. 1, 1918, 35,710,000 tons. This is a decrease of 6,290,000 tons. Taking the Allied Nations alone, the position on Aug. 4, 1914, was about as follows:

Great Britain	20,000,000 tons
France	2,300,000
Italy	1,700,000
U. S. A.	8,000,000
	32,000,000

The Falling Off

Now, taking the normal development in peace time, this shipping should have shown an increase of approximately 17½ per cent., or 5 per cent. per annum. That is, the total on the 1st Jan., 1918, should have been 38,400,000, instead of which it was only 24,900,000, a shortage of 13,500,000 tons. Since then to the close of the war the losses and new construction have about balanced, so we may say the world is short of tonnage by the amount stated. At the present rate of building it will take approximately two to two and a half years to make up this loss, without counting the ordinary losses incidental to navigation in peace times, from marine casualties, and ships going out of commission through ordinary depreciation, or old age.

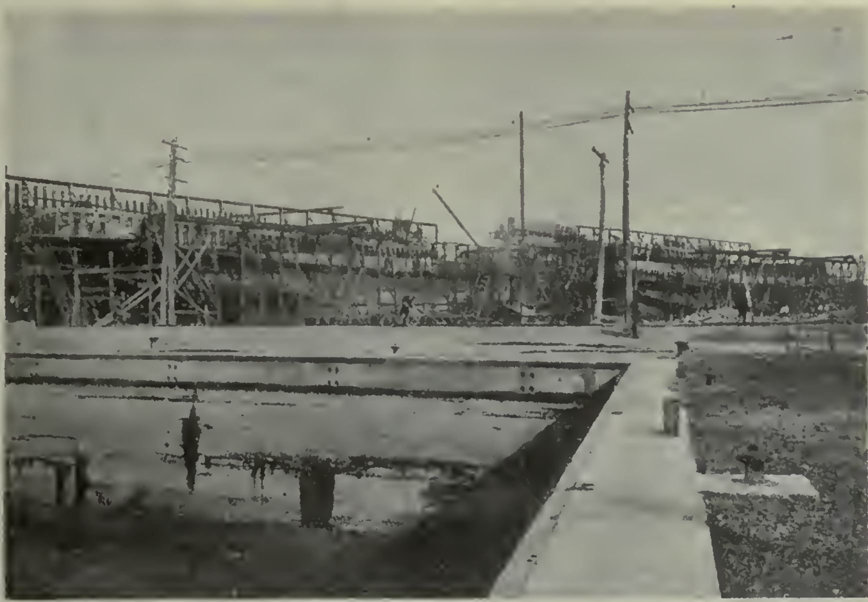
The distribution of the world's tonnage will show a considerable difference when the losses are finally made up.



ONE OF THE OLD BRIGADE

Britain Hard Hit

Great Britain has been the heaviest sufferer, by far, from the losses due to war, and her building activities have been hindered, not only by the necessity of building war vessels, especially of the anti-submarine type, but by the enormous amount of repair work she had to undertake, and also the fact of so many of her skilled men being drafted into the fighting forces. Before the war Great Britain owned and operated fifty per cent. of the total world's tonnage. After the readjustment period she will probably be owning only one-third of the total tonnage, with half of the remainder owned by the United States, and the rest divided between the remaining maritime nations. Competent authorities estimate the total deadweight tonnage in 1914 at 60,000,000 tons. If this total is again realized two years after the close of hostilities, it will mean that Great Britain will own 20,000,000 tons, the United States the same, and Japan, France, Germany, Norway, and the smaller maritime nations divide the rest between them. In the British total the tonnage of the Dominions of the British Empire has been included. This was because the shipping of the Dominions combined were but a small percentage of the total British shipping, and most of their ships were built in Great Britain and remained under English registry. Australia and New Zealand got practically all their ships built in Great Britain, and in Canada the building was confined mostly to smal:



WOODEN SHIPS ON THE WAYS

vessels, many of them wood. On the Great Lakes there were some good sized steel vessels built for Canadian registry by Canadian builders, but most of the lake freighters were built in U.S. yards.

The Effect of the War

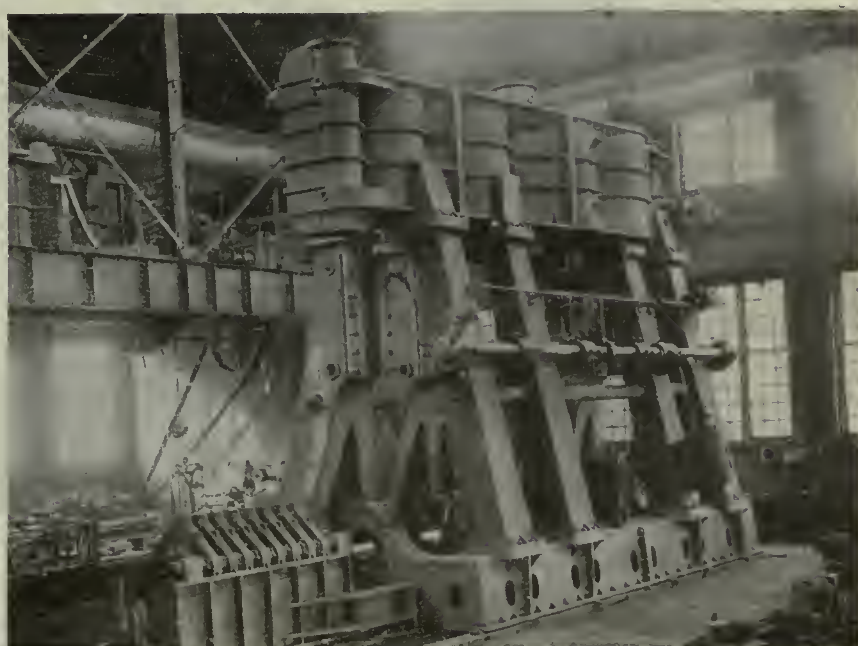
Before the war, Canada's mercantile marine was confined to the lake steamers and small coasting vessels. The United States was in the same position excepting that they had a large fleet of coasting steamers, due to the fact that under the United States laws no vessel can trade on their coasts unless they are under the American flag. A large part of Canada's coasting trade was handled by Norwegians. The United States, since coming into the war, has entered into a shipbuilding programme that will raise her, in two years more, from a negligible factor in the marine world, to a position of equality with Great Britain, the proud mistress of the seas. Canada, in order to contribute to the urgent war need for ships, jumped into the shipbuilding game with a vim, and achieved wonders, and now that peace has come, intends to carry on the good work, and have her own merchant fleet to carry her own goods. The Canadian Government has entered into quite extensive operations in the ship-owning line, and will, in the near future, be the owners of 39 large steel cargo vessels. These will represent a large investment, and the country will have keen interest in watching their future operations, whether they are financially successful or otherwise.

Canada's Achievements

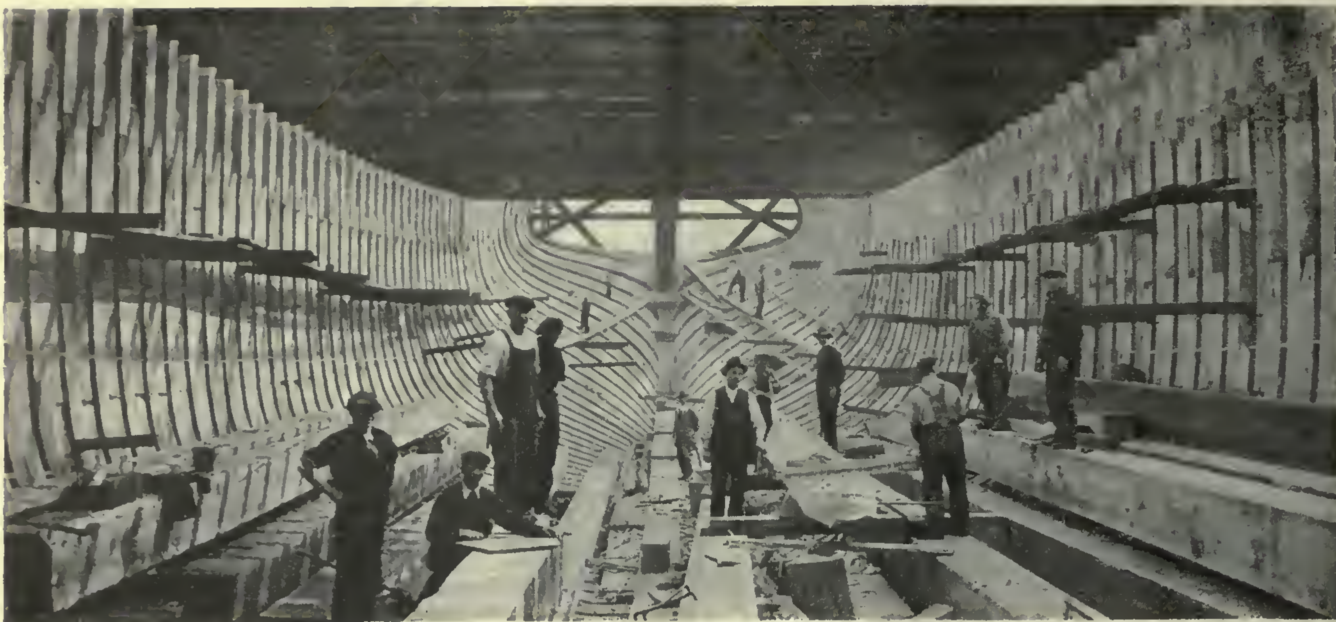
At the beginning of the war, Canada's shipbuilding activities were limited to some construction on the Great Lakes, small wooden vessels round the coasts of the Maritime Provinces, and wooden vessels of varying sizes up to 1,000 tons on the B. C. coast. On the St. Lawrence the Canadian Vickers had established a modern shipbuilding and ship-repairing shop, with a large floating dry dock at Montreal, and further down the river there were other dry docks and yards. The Canadian Government had a ship yard and repair shop at Sorel, and at Quebec were the yards of the Davie Shipbuilding and Engineering Co. The Canadian Vickers yard at Montreal is the Canadian branch of the English firm of Vickers Maxim. The Naval dockyard at Halifax was practically shut down, and the same might be said of the one at Esquimault. This was the result of Sir John Fisher's policy when First Lord of the Admiralty. At the end of 1914 there were on the books of the Canadian Registry 8,772 vessels. Of these, 4,054 were steamers, of a gross tonnage of 744,783 tons. This gives an average of less than 200 gross tons each, in fact there were only one hundred and ninety-two steamers of over 1,000 gross tons on the register. At the end of 1917 there were 221 steamers of over 1,000 tons registered in Canada, but a good number of vessels had been built for export.

The Contracts Came

The Imperial Munitions Board, which was created in 1915, turned its attention to shipbuilding, with the result that contracts were given in Canada for 43 steel ships, and 58 wooden ships, with a total deadweight capacity of 360,000 tons. The value of these contracts was $70,000,000, and was divided between British Columbia, Ontario, Quebec, and a small portion to the Maritime Provinces. There are at present in Canada 45 berths for building steel vessels of 3,000 tons up to 10,000 tons, besides the yards devoted to wooden shipbuilding. The ships for the Imperial Munitions Board to be launched this year, both steel and wood, are 79 in number, aggregating 318,400 tons deadweight. Besides these ships, 11 steel vessels have been built for the Marine Dept. of the Government, with a capacity of 48,000 tons. For private owners, 14 steel vessels with a deadweight of 62,400 tons have been built, as well as 8 wooden vessels of 17,800 total deadweight. These figures are all for vessels of over 1,000 tons. Besides these vessels, Canada has supplied 550 submarine chasers for the Imperial Government, and 36 for the French Government. A number of drifters and trawlers have also been supplied to the Imperial Government. Truly, this is a remarkable effort, considering the amount of work that the country was putting into its munition industry, and taking into account the handicaps which the industry was up against. Labor of the right kind was hard to get, and in too many cases, hard to get along with.



TRIPLE EXPANSION ENGINES OF SS. HAMONIC. BUILT BY COLLINGWOOD SHIPBUILDING CO.

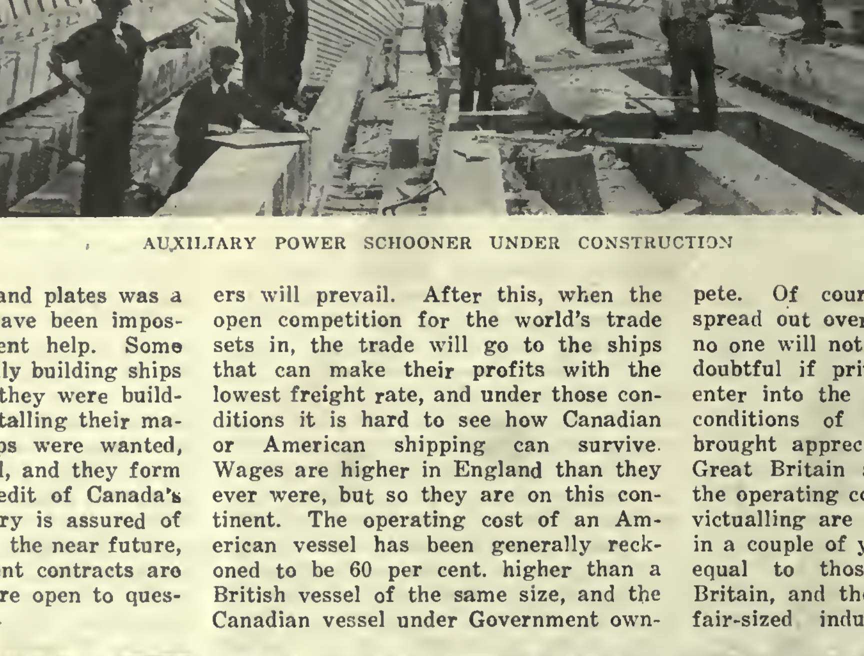


AUXILIARY POWER SCHOONER UNDER CONSTRUCTION

Securing steel sections and plates was a hard task, and would have been impossible but for Government help. Some of the yards were actually building ships at the same time that they were building their shops, and installing their machinery. However, ships were wanted, and they were furnished, and they form another item to the credit of Canada's war effort. The industry is assured of a period of prosperity in the near future, but after the Government contracts are through, its prospects are open to question.

Looking to the Future

Figures are obstinate things, and there is no burking the fact that to build a ship in Canada at the present time costs $200 per ton, against $120 per ton in England. Repairs cost about 80 per cent. higher on this side of the Atlantic, and several cases can be quoted where vessels have been towed several thousand miles to an English repairing yard, rather than have extensive repairs made abroad. The Canadian Government has expressed its intention, which is being carried out, of building a mercantile marine. This will be operated as a stock company by the Railway Board, and its profits or loss will be easily seen. Till the merchant fleet of the world gets back to its normal standing, an era of high freights and profits for ship owners will prevail. After this, when the open competition for the world's trade sets in, the trade will go to the ships that can make their profits with the lowest freight rate, and under those conditions it is hard to see how Canadian or American shipping can survive. Wages are higher in England than they ever were, but so they are on this continent. The operating cost of an American vessel has been generally reckoned to be 60 per cent. higher than a British vessel of the same size, and the Canadian vessel under Government ownership will approximate near to that. A capital investment of $200 per ton against $120 per ton means 40 per cent. higher, and if operating costs are only 30 per cent. higher, it is hard to see where the Canadian vessel could compete. Of course, the losses will be spread out over the whole country, and no one will notice it much, but it seems doubtful if private firms will wish to enter into the shipowning business. If conditions of building cost could be brought appreciably near to those of Great Britain and European countries, the operating costs, so far as wages and victualling are concerned, will probably, in a couple of years from now, be fairly equal to those prevailing in Great Britain, and there will be a field for a fair-sized industry in Canada. The establishment of plate mills in Nova Scotia, Ontario, and perhaps later in B. C., would help materially in reducing costs of building, while the adoption of standard ships would reduce the amount of skilled labor required, this also tending to make first cost less. In the meantime, the Government contracts and those for export will keep the yards busy.



LAUNCHING A 3,500-TON STEEL SHIP

The Wooden Ships

There are 313,000 tons of wooden shipping building for export, while the Government's contracts for its 39 ships amount to 250,500 tons and a cost of about $45,000,000.

The building of a ship entails the employment of practically every trade known to man, and calls in dozens of other industries to supply equipment. We find the work of instrument makers, represented by the compass, telescopes, binoculars, etc. The hydrographic experts are represented by the charts, and the publishing business by the various books of sailing directions, tide tables, navigation tables, etc. Here also is the ship's telegraph, usually made by some firm specializing in these instruments, which afford the means of communicating orders from bridge to engine room, forecastle head, and poop. The wireless apparatus, steam boilers, engines, ship's lamps, binnacle lights, etc., pulley blocks, snatch blocks, gin blocks, anchors and chains, winches and windlass, steam and hand pumps, are all parts of equipment calling in the services of specialists. The carpenter lays the decks, and the joiner does the fitting up of cabins. The upholsterer is needed here, too. Electricians to do the wiring, plumbers for the sanitary arrangements, painters, nickel platers, French polishers, marine engineers,—the list is endless. Such an industry is worth holding if at all possible, but that means it must be self-supporting. An industry which is kept going by the help of one part of the population to keep another part in employment, is not a good investment for the country. It reminds one of New Zealand, of which it has been said that one half of the country pays taxes to pay the other half for collecting them

Various Types of Ships Built

The scarcity of steel, and its high price, together with the difficulty of getting skilled men, turned the attention of shipbuilders in the Allied countries to the use of other materials, and to quicker methods of handling the construction of steel vessels. The fabricated method, adopted in Great Britain and the States, of building steel ships, has materially shortened the period of building. In this method a standard size and type of ship is determined on, the scantlings of which can be made at any steel construction shop, and then shipped to the various yards where the hulls are being built. This eliminates an enormous amount of work in the moulding loft. Some work has been done utilizing electric welding instead of riveting, but this is largely in an experimental stage. The building of large vessels in concrete was the most radical departure made. The wooden vessel was but a reversion to an old type, and was confessedly a substitute, and not a rival to steel, and while concrete barges and boats of small sizes had been built at various times since about 1850, the construction of large vessels of ferro-concrete was something absolutely new. Its future is doubtful, for reasons which will be discussed later on in this article. The steel and wooden vessels fitted with internal combustion engines have increased considerably. Some of these depend entirely on the oil engine for propulsion, while others have the aid of sails. In Great Britain the steel cargo carrier fitted with heavy oil engines has attained a size of 10,000 tons d.w., and the appearances are that there will be a large expansion of this type when builders get time to turn more to peace construction. The turbine, driving through reducing gears, has been fitted in some large vessels, and the steam turbine driving the shafting through direct connected electric generators and motors, has had some highly successful applications.

3,500-TON STEEL SHIP AFTER LAUNCHING

Using Wind and Power

The auxiliary sailing vessel, by which is meant a vessel depending in the main on her sails for propulsion, but with power available when winds are light or unfavorable, is a good proposition in some particular trades owing to their lower running expenses and larger amount of available cargo space compared with a steamer of the same size. A large number of these vessels have been built on the British Columbia and American Pacific coast. For large high-speed vessels, such as first-class passenger liners, the steam turbine driving through a suitable reduction gear would seem to be the motive power of the future, while it is probable that for the ordinary cargo vessel up to 10,000 tons, the internal combustion motor will gradually replace the reciprocating engine. The triple expansion engine will die hard, but it would seem that with increasing experience the oil engine will be brought to as great a state of perfection in design and manufacture as the multi-stage steam engine, and then its inherent advantages as a heat engine will give it first place.

Reinforced Concrete vs. Steel

The steadily mounting cost of steel,

CAR FERRY "ONTARIO," NO. 2. BUILT BY POLSON IRON WORKS, TORONTO.

coupled with the necessity of producing ships quickly, with a minimum amount of skilled labor, led naval architects in Great Britain and the United States to the consideration of reinforced concrete vessels. As stated before, this was not a new method, the only thing being that it had not been used for vessels of large size. The first reinforced concrete boat was a small rowboat, built by a Frenchman named Lambot, of Carces, France, and patented by him in 1849. The next vessel of which there seems to be any record, was a sloop called the Zeemeuw, built in Holland in 1887, and reported to have been in constant service ever since. The firm of C. Gabelllini, Rome, between 1896 to date, constructed various lighters in ferro-concrete, and these have been satisfactory to the Italian officials. Concrete scows and barges have been constructed in various parts of the States up to 500 tons, a scow of that size being built in 1912 by the First Concrete Scow Construction Co. of Baltimore. In England and Norway concrete barges, dredges, etc., have been built at various times, and in Norway the practice of building barges bottom up and launching them that way was developed. The reason for this is that it lends itself to a better mixing of the material, and allows the use of a thinner covering of concrete over the steel. The largest vessel constructed of ferro-concrete has been the Faith, a 5,000 ton deadweight steamer built in San Francisco this year. Many extravagant claims were made as to the future of the concrete vessel, but it would seem that once normal conditions return, there will be nothing to be gained by its use for vessels of more than 1,000 tons.

More Comparisons

As the larger size of steamer is approached, the amount of steel required increases, until the weight of steel is about 75 per cent. the total weight of the hull. Great care has to be exercised in the placing of the reinforcing and in holding it in place while the concrete is being poured. Climatic conditions in some parts interfere with the procedure of the work, and there are more skilled men required than was at first thought necessary. The weight of the concrete hull is considerably greater than that of a steel hull of the same size, which means that the cargo carrying capacity of the concrete ship is less. Taking the standard 3,500 ton concrete ship constructed in the United States, some interesting comparisons are given. The dimensions are practically the same as a wooden ship of the same tonnage, namely: o. a. length, 281 feet 10 inches; length between perpendiculars, 268 feet; beam over shell, 46 feet; depth amidships, 28 feet 3 inches; draught, 23 feet 6 inches. The steel vessels built in Canada for the Imperial Munitions Board of the same tonnage are 261 feet o.a. long, by forty-three feet six inches beam, and 23 feet deep. That is twenty feet shorter, 2 feet 6 inches less in beam, and five feet less in depth. The following table is given in the report of the Concrete Ship Department, U.S.A., on the concrete ship:

Comparative Weights of Concrete Wood and Steel Vessels

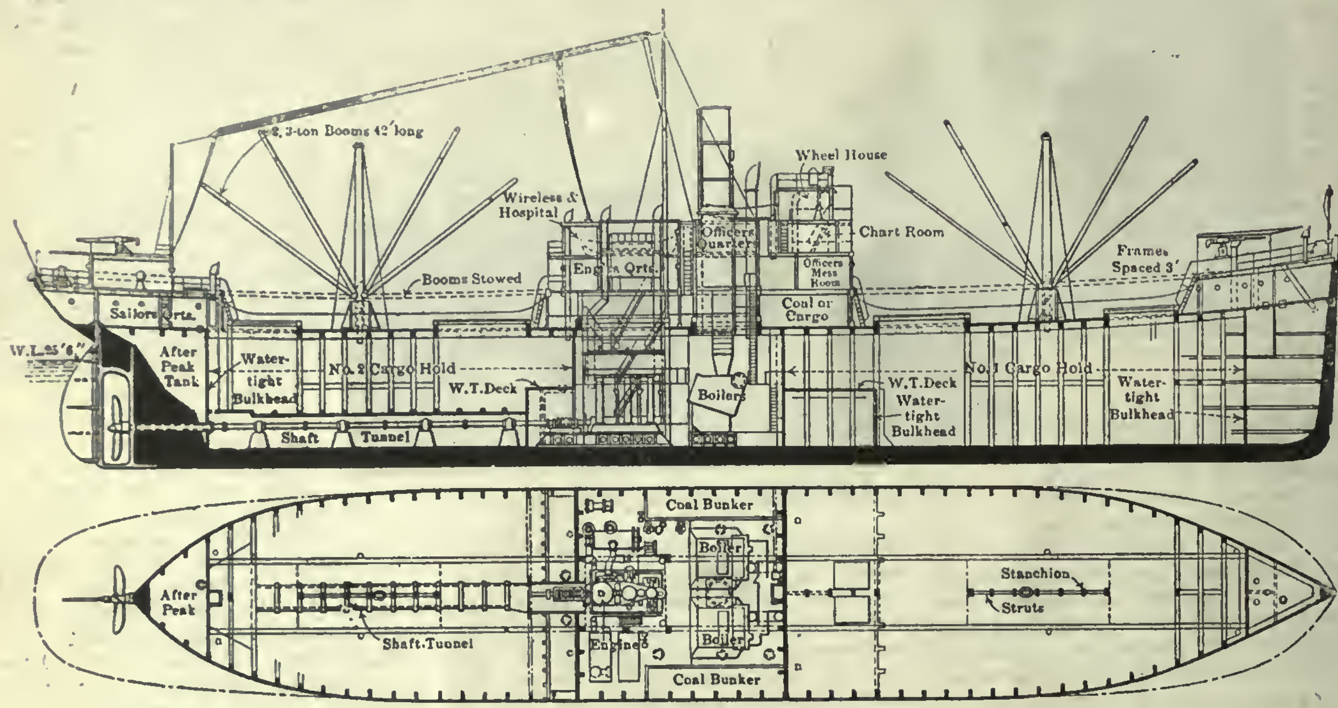
	Concrete	Wood	Steel
Hull	2,500	2 300	1,160
Fittings and equipment	191	191	180
Machinery	206	206	200
Margin	75	80	60
Ship (light)	2 972	2,777	1,600
Reserve Feed, Stores, Ordnance, Fuel	443	443	443
Cargo	2,760	2 680	3,057
Total deadweight	3.203	3,123	3,500
Full load displacement	6,175	5,900	5,100
% dw. to full load displacement	52	53	68.6

Can't Carry As Much

This shows that the earning power of the concrete ship of these dimensions will be less than that of the steel ship, directly by the amount of cargo less that she can carry. She will be more expensive to operate inasmuch as, if fitted with the same powered machinery she will require a longer time to make the same voyage, making the wages and victualling bill greater, or if fitted with propulsive power to make equal speed with the steel vessel, her fuel cost will be greater. Against this must be put the lower cost of construction. These vessels were estimated to cost $112.50 per ton deadweight, while the average cost for the steel ship was about $190 per ton d.w. The low cost is, in this case, due to figuring on a large number of vessels being made in the same yard, in which case the cost of shuttering, etc., would be much less, owing to it being used on several ships in succession. The cost would probably be closer to $150. In a paper read before the Institute of Naval Architects, Major Maurice Denny (member) gives some interesting figures; also a mathematical comparison of the steel and concrete ship earnings. He gives a comparison of a 375 ft. long steamer, of each type, of 9,900 tons displacement:

	Steel Ship Tons	Concrete Ship Tons
Displacement	9.900	9,900
Steel Hull	1,920	Steel 680
		Concrete 2,470
		3,150
Ship Light	2,890	4,070
Deadweight	7,010	5,830

We see therefore that in the 3,500 ton vessel the cargo capacity of the concrete hull is 90 per cent. of the steel, but in the larger vessel the percentage is only 83. So that in the concrete vessel, as the vessel gets larger, the cost



PLAN AND ELEVATION OF 3,500-TON CON CRETE SHIP.

of construction increases and the cargo capacity gets less compared to the steel hull. Major Denny then makes the following analysis of costs. Taking the steel vessel he allows the following values:

Bare hull	100
Machinery	50
Remainder	40
	190

Depreciation at 5% = 190x.05.
Other exs. = Z.
Profits at Y% = 1.9Y.
Earnings therefore are 9.5+Z+1.9Y.
The concrete ship will figure out thus.
Let X = cost of bare hull.
Machinery, etc. = 90.
Then X+90 = cost of ship.
Depreciation at 5% = .05 (x+90).
Other exs. = Z.
Profits at Y% = .01Y.
Then earnings = Z+(.05+.01Y) (X+90).

If deadweight is measure of earning capacity and concrete ship carries .83 of steel ship, then .83 (steel ship earnings) = concrete ship earnings.

÷ .83 (9.5+Z+1.9Y) = Z + (0.5 + .01Y (X+90).

$$\text{Solving } Z = 67.7 - \frac{1.7Z}{5+Y} \text{ or say } 68 - \frac{17Z}{5+Y}$$

A Comparative Table

From the above results Major Denny derives the following table for varying values of Y:

Y	X
0	68—3.4Z
5	68—1.7Z
10	68—1.1Z.
15	68—.85Z
20	68—.68Z

From this it is evident that under no circumstances must the cost of the bare hull of the concrete ship be more than 68 per cent. of the cost of the steel hull if the profits are to be equal. Major Denny then goes further in his calculations and shows that when freights are low the concrete ship cannot pay expenses. Allowing for the term Z a value of 50, which covers management, stores, wages, insurance, docking, repairs, coal, dues, loading and discharging expenses, etc., the figure of 50 is reasonable, representing 26 per cent. of total cost of ship per annum. Then by substituting the figure 50 for Z in the table above:

Y	X
0	—102
5	— 17
10	13
15	26
20	34

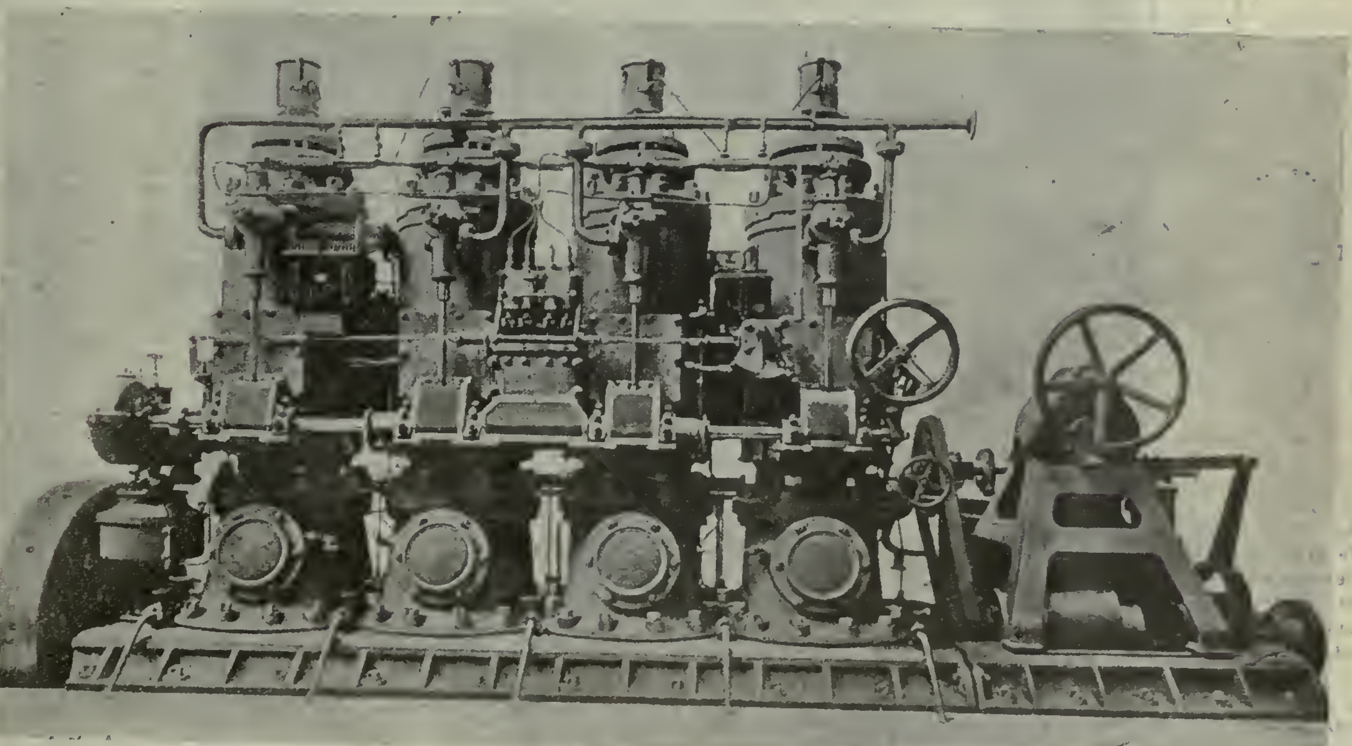
This shows that when the steel ship is earning 20 per cent. per annum, the concrete ship to earn the same dividend must have a bare hull cost of the steel ship. Major Denny points out that these figures are qualitative only, and are not advanced as a complete and detailed analysis of the problem.

Steel Will Be Lower

There is no doubt that the cost of steel will eventually become lower, and taking everything into consideration, the future of the concrete ship of large size is doubtful. For such vessels as canal barges, lighters, landing stages, etc., ferro-concrete should have a good field. It has some excellent points from the point of view of resistance to shocks, such as collision, bumping into wharves, and loading heavy materials from a height. Damage to concrete from blows is entirely local, and an instance is quoted of a concrete water tank in France, on top of a 75-foot tower, having the tower shot from under it, the tank sustaining no damage in the fall. If concrete ship designers succeed in bringing the weight of the concrete hull to approximate the weight of the steel hull, and still further reduce the amount of steel necessary, there will be a much better prospect of the large concrete vessel coming into general use. The performance of the vessels already built after two or three years' sea service will also furnish valuable information.

Conclusions

There have been many millions of dollars invested in the United States and Canada in plants for the building of ships and ship engines. The object in both countries was to help in the war, and further to develop a mercantile marine of their own. The United States feel that as a great nation, they should not be dependent on foreign ships to carry their cargoes, and that feeling has been more intense since 1907, when their fleet took its famous trip round the world. On that occasion they had to depend on British ships to supply them with coal. In recent days, more than half their army in France was carried over in British ships. Canada feels that to expand her trade she should have her own mercantile marine. Great Britain, during the war, has lent her ships to everybody that needed them, and concentrated on one object, winning the war, and in doing this has let her maritime trade connections slide.



DIESEL OIL ENGINE OF EUROPEAN DESIGN

Tyre Making a New Canadian Industry

DEVELOPMENT OF ARMSTRONG-WHITWORTH PLANT

FOR the second time in less than four years the firm of Armstrong, Whitworth of Canada, Ltd., have inaugurated a new industry into the activities of the Dominion. In the beginning of 1915 this firm, which is the Canadian branch of the parent company with factories at Manchester and Newcastle, England, commenced its initial enterprise in the newly built and modernly equipped plant at Longueuil, P.Q., opposite the Island of Montreal, and on the south shore of the River St. Lawrence. Anticipating future development from the growth of the business the original plans provided for buildings to accommodate additional expansion. The site selected offered excellent facilities for every phase of the company's activities, the adjoining town of Longueuil being conveniently situated for the accommodation of all the employees of the works, and with the north end of the property touching on the shore of the river. ample docking facilities are available for water shipments. Montreal, being an ocean port, aids materially in this respect, particularly for export business. The extent of the land controlled by the company approximates two hundred and fifty acres.

All the buildings are constructed of reinforced concrete with steel framework supporting the crane runways and the roof. The main building consists of a series of parallel shops and is so designed as to permit of additions to any or all of the bays without disturbing the present arrangement. Owing to the nature of the work engaged in, requiring many furnaces and ovens, and to maintain a free run for the crane in each main bay, narrow bays of about twenty feet wide are located between each of the main sections. To facilitate the handling of material when it is delivered to the plant, and for the shipment of the finished product, standard railway tracks are located through the center of each main section; local transfer being made on small trucks that operate on these standard tracks.

BATTERY OF SIX-TON HEROULT FURNACES

The pioneer work of this concern was in the manufacture of high speed and crucible steels, and high speed steel products such as taps, dies, punches, mining drills, milling cutters, twist drills, reamers, and tool steel bars, rolled and hammered into the various sizes and sections.

Casting The Ingot

The most recent developments in the activities of this firm is that of the manufacture of tyres for locomotive driving and truck wheels; this work will be supplemented in the near future by the production of forged steel wheels, the equipment for which is already installed. The process of making these steel tyres is not a very elaborate one, but the different operations are exceedingly interesting and the character of the work demands a thorough knowledge of the physical conditions of the steel under the treatment of the different furnaces and forming machines. The first detail in connection with the work of tyre making is the charging of the electric furnaces with the necessary material, which is composed of selected steel scrap.

The approximate time required to convert this scrap into molten metal is about 5 hours. Test pieces are made from the charge to see that the metal meets the required specifications, and

SHOWING LADLE IN POSITION, RECEIVING MOLTEN CHARGE OF STEEL

when necessary the desired alloys are added to change the molten metal to conform to the physical and chemical requirements. When all these conditions are assured the molten metal is poured into the large 10-ton ladle. When pouring the steel from the furnace to the ladle, the latter is located in an enclosed space at the front of the furnace. On the upper edge of these side walls are heavy steel plates that can be adjusted to protect the workmen from the excessive heat of the molten metal.

After the ladle has received the charge it is taken up by the crane and transferred to the ingot moulds that are generally arranged in parallel rows on the foundry floor. The ladle is of the bottom pouring type and the nozzle is kept as close to the mouth of the mould as conditions will permit. The moulds are shaped somewhat after the style of an inverted bowl, the size conforming to the weight of the metal required to make the tyre. In calculating the amount of metal required in the ingot, allowance must be made for the loss due to the scaling of the three reheatings, and the center that is removed from the bloom after forging to the desired thickness. The piping in the center of the ingot is not great, and owing to the fact that this portion is afterwards punched out, it leaves very sound steel for the tyre.

First Reheating

From the casting floor the ingots are taken to a specially designed low lift elevator located at the receiving end of the long continuous furnace; this lift is shown at the lower left corner of the plan layout. The elevator is operated by a small electric motor, and when the ingot reaches the top it is transferred across a short runway to the furnace loading platform. From this position the ingots are pushed into the continuous furnace by means of the specially constructed electrically operated pusher, which is controlled by the action of a screw feed located beneath the platform. This feeding of the ingots into the furnace chamber is in the charge of an operator whose duty it is to see that the ingots are placed in regularly. The burners for heating this furnace are so arranged that the heat of the chamber increases from 560 degrees at the feeding end to about 800 degrees at the discharge end. The floor of this furnace is set at an angle of about 10 degrees and the billets rest on two parallel pipes that run the entire length of the fire chamber, a distance of about 60 feet, sufficient to accommodate approximately 50 ingots of 750 lbs. each. The two pipes that form the runway are kept cool by the circulation of cold water. The ingots are discharged from the long section of the furnace down a short 45 degree incline, into the final heating chamber which has a capacity of half a dozen ingots. The time required for the passage of an ingot through this furnace is about three hours. In this and subsequent heating it is very essential that the temperature be even throughout, otherwise defects may develop in one or other of the forming operations.

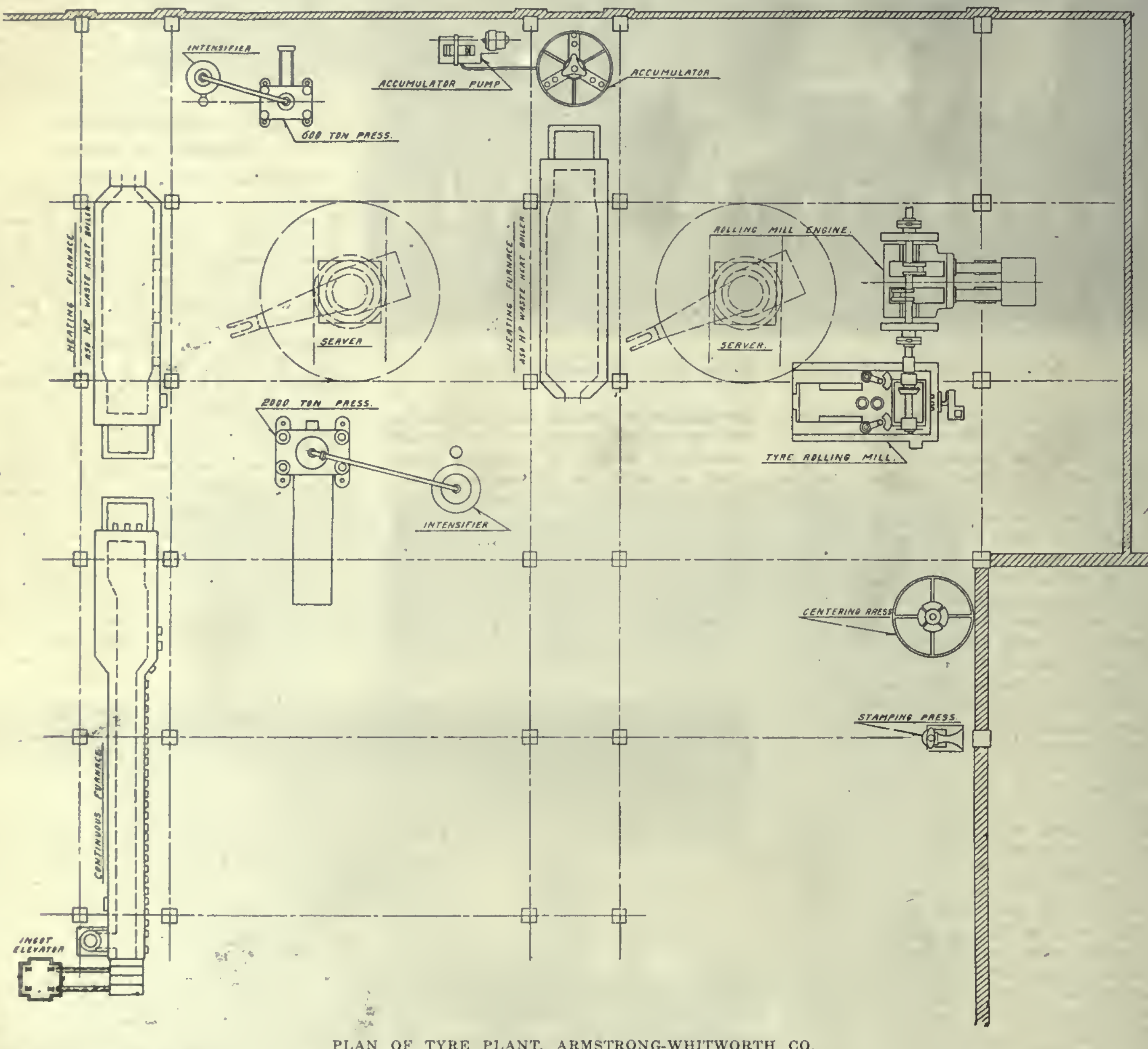
Forming the Bloom

When the ingot is raised to the desired temperature of about 1800 degrees F., it is removed from the furnace by means of a special server operating on the crane runway. This and the other servers, which were made by the Wellman, Seaver and Head, Ltd., of London and Bath, England, have a range of 360 degrees and can be operated to serve any of the furnaces or presses within its radius and the travel of the crane in either direction. The ingot or bloom is supported on the forked end of the server arm and then placed on the heavy anvil of the 2000-ton steam intensifier hydraulic forging press, which is located in the middle of one of the main bays. This press is provided with two anvils, either of which can be located in a central position for the operation desired. The breaking down anvil, which is made solid, can be revolved about its own center, this movement being necessary when extra large blooms are re-

TEEMING TYRE INGOT FROM LADLE INTO INGOT MOULDS quired. When the bloom is flattened to a thickness of 6 inches, the average width of a finished tyre, the press ram is raised and the bloom is grabbed by a pair of prongs operated by intricate levers supported in a framework at the side of the press. This appliance is hydraulically operated and can be seen at the lower left of the large press.

Piercing the Bloom

With the work held firmly in the prongs it is slightly raised from the anvil, and the movement of the lower slide brings the anvil that carries the piercing die into the central position below the ram. The bloom is then dropped on the die and the anvil brought out again so that the piercing punch can be placed in position. This consists of a steel block 10 inches in diameter and is located solely by the eye of the man in charge of the press. The anvil is returned beneath the ram and the lowering of the same forces the punch through the bloom, and the former and the piece punched out, passes through the die. The bloom is again supported by the side arms while the main anvil is brought below the ram, when the bloom is again flattened. It might be mentioned that the control and operation of the press and other mechanisms is in the charge of one man.



PLAN OF TYRE PLANT, ARMSTRONG-WHITWORTH CO.

Rough Forging to Shape

The pierced bloom is now ready for the second reheating, which is done in a furnace located at the discharge end of the continuous furnace and between the breaking down press and the one used for the becking of tyre. The pierced bloom is again brought to a temperature of about 1800 degrees F. and by means of the server is taken from the fire and located on the horn of the 600-ton steam intensified hydraulic becking press. The work performed on this press consists of a series of pressures on the outer diameter of the bloom that in a short time produces a ring roughly resembling, and of a diameter about three or four inches less than the finished tyre. The horns used are of different diameters to suit the size of the tires being made, and are located in a housing with the working surface about four feet above the floor level. The horns are placed at an angle of about 15 degrees and the face of the pressure block, that is fitted to the press ram, is at a corresponding angle. This inclination assets in the formation of the flange and maintains the inner face against the shoulder of the housing, this latter action being further aided by means of a long bar suspended in a notched cross bar fixed to the two-side pillars of the press. This bar is operated at the outer end by two workmen, as considerable pressure is required to keep the ring in position. Following each successive pressure or swage, the ring is revolved through an angle of approximately 15 degrees. This operation is controlled by one man using a long bar fulcrumed in a notched bar laid on two supports and extending across the front of the press about two feet above the floor. A series of notices are made on the top of the bar to accommodate the different dia-

2,000-TON STEAM INTENSIFIER FORGING PRESS, FORGING INGOT INTO TYRE BLOOM

meters. It might be stated that forming blocks of any desired shape may be adopted to suit the work in hand. The time required to shape the tyre at this operation varies from 3 to 7 minutes, according to the size and weight of the tyre. The work on this flanging press roughly rounds the tyre into shape, but before it is placed into the third reheating furnace it is placed back in the large press and again flattened.

Final Rolling Operation

The last heating of the tyre is performed in the furnace located in the center of the department and this furnace is open from either side, so that the righly formed tyre is placed in on the one side and removed from the opposite side.

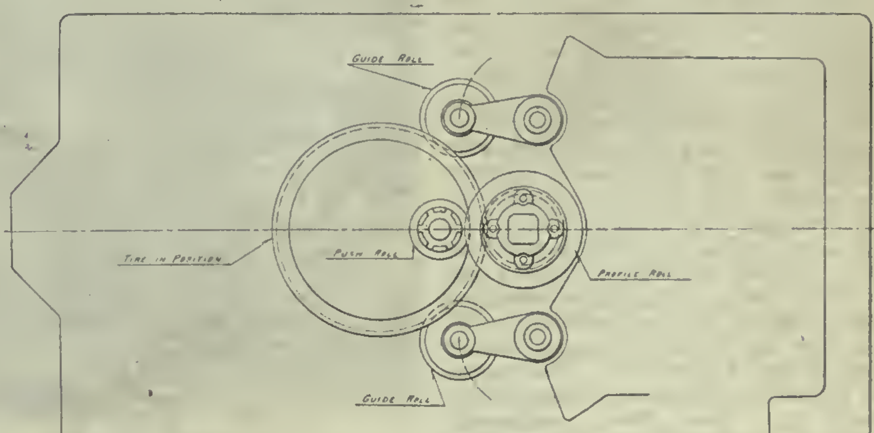
The heated ring is again taken up by another mechanical server and removed to the rolling mill, where the final operation is accomplished. The heavy duty engine that drives this mill is of about 1500 h.p., and was constructed by the International Engineering Works. This unit is directly connected to the Morgan tyre rolling mill. In this operation of rolling the tyre to the finished size and shape it is imperative that the steel be uniformly heated to assure a satisfactory product. Immediately the heated ring is placed over the push roll, the latter, which is operated by means of a hydraulic cylinder beneath the machine, is forced up and against the inner edge of the ring and in turn presses the ring into the profile roll which remains in a fixed position. The operating cylinder is 18 inches in diameter and with a working pressure of 1500 lbs. per sq. in., the pressure exerted on the tyre for the rolling process is upwards of 100 tons. Guide rolls are located on either side to steady the work while in action and to round up the tyre to the desired shape and concentricity. During the rolling of the tyre running water is permitted to flow on the work from between the guide rolls and the profile roll, and in addition to this a man is employed in directing a stream to the inner surface of the ring, or to such places as are desired. When the required size has been obtained or nearly so, the pressure is steadily maintained, but no more water is alowed to pass into the cylinder, so that the push roll remains in the one position. It is necessary to do this while excessive heat remains in the steel, as the contraction would otherwise be too great and when the tyre cooled off it would probably be below the desired size.

The gauge adopted for determining the finished size is quite interesting and is so accurate that during the final revolutions in the rolling of the tyre it does not show the least variation from its indicating point on the graduated gauge. The construction of the gauging attachment is such that the indicating point is always in the same position, irrespective of the size of the tyre being made, and is always within the direct line of vision of the control operator. The concentricity of the tyre at this point is virtually perfect. When the tyre begins to turn black the pressure is removed and the tyre taken out of the machine and placed to cool. The shrinkage on a 32-inch tyre after being removed from the rolling mill will be about ½ inch, and in the case of a 74-inch tyre the shrinkage will be approximately 15-16 inch. For machine finished tyres the amount of stock left on the inner and outer diameters is about 3-32 of an inch.

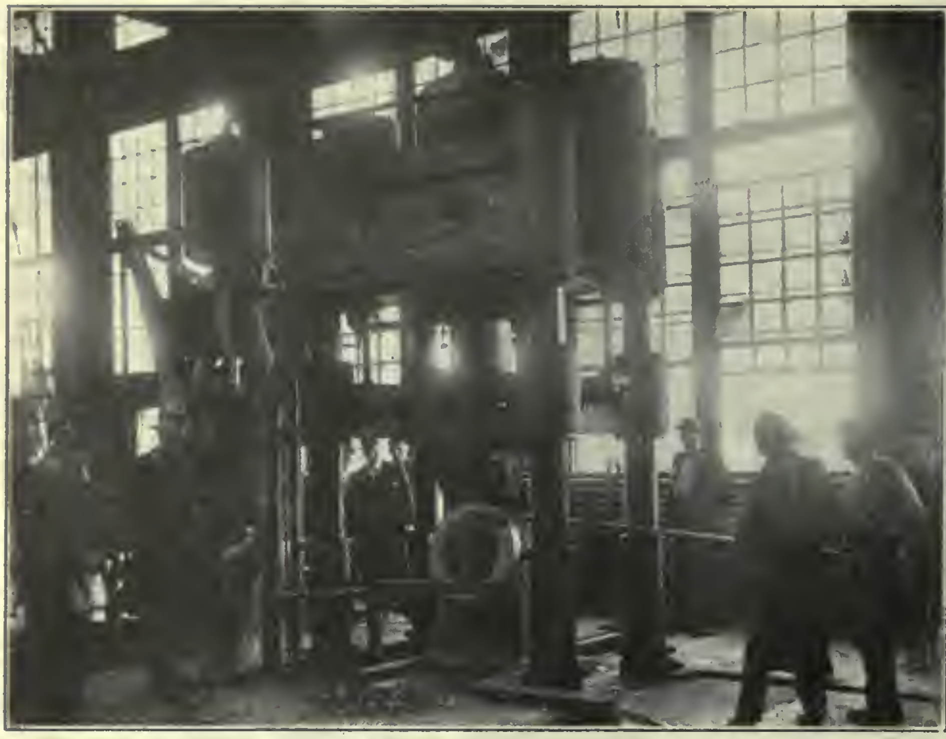
Heating With Powdered Fuel

A feature that deserves special mention in connection with the operation of the furnaces is the utilization of powdered coal for fuel. The plant for this purpose was installed in 1917 and the system has given such good results that it has been adopted for use on the majority of the furnaces in the plant. Experiments with powdered fuel on the two 18-ton basic open hearth furnaces recently installed, have proven its adaptability in this respect and its permanent application is now being considered. The plant that has been constructed for the purpose is capable of producing five tons of powdered coal per hour. The system is divided into three separate circuits so that fuel can be supplied to or cut off from any one department without affecting the supply to the others. The operation of the system is virtually automatic in its action, the powdered fuel being in continual circulation. The cutting out of any of the furnaces in a department does not affect the distribution, as the operation of the air control valves regulate the speed of the small motors that drive the fans for blowing the fuel through the delivery system.

As in the initial activity of this firm this latest enterprise of tyre and forged steel work marks a new epoch in the steel industry of Canada, and likewise represents anothed blow to German supremacy, as the majority of Canadian



PLAN SHOWING MACHINE FOR ROLLING TYRES.



6,000-TON STEAM INTENSIFIER HYDRAULIC BECKING PRESS, FORGING BLOOM INTO ROUGH OUTLINE OF TYRE

locomotives and cars, before the war, were running on Krupp tyres. Prior to the establishment of the plant of Armstrong Whitworth the supply had been coming from the States, while now the Canadian railroads are assured of ample home made tyres for all their requirements.

To the establishment of the plant the credit is largely due to the efforts of Sir Percy Girouard, K.C., the president of the Company, and G. G. Foster, K.C., the vice-president, while the successful development to its present efficiency is due to M. J. Butler, C.M.G., the managing director, and his able assistants Lawrence Russell, assistant general manager, and H. Johnson, the general superintendent.

METHOD OF SYNCHRONIZING ELECTRIC MACHINES

By M. M.

A new method for synchronizing electric machines, is a development from one already used. It consists in connecting choking coils in the alternating current leads, bringing the machine to the neighborhood of synchronism by an auxiliary machine, and then gradually exciting. If the choking coils are suitably designed the machine will fall into synchronism after one or two oscillations. When this has taken place, the choking coils are short-circuited, which gives rise to a considerable current rush. It is also possible to use an induction motor for starting, with its windings connected in the place of the choking coils. This causes the reactance to decrease as the machine starts up. Even then considerable rushes occur when the induction motor is short-circuited. The reactance of the serious choking coils is decreased automatically and gradually, to such an extent that practically no current rush takes place when they are short-circuited A further advantage of the method lies in the freedom of choice of the type of the auxiliary motor. The reduction of the reactance of the choking coils is affected by superposing a direct current field upon the alternating current field. Direct current excitation of the choking coils may be drawn from the commutator of the rotary converter that is being started up, and the choking coils may be inserted either on the primary or on the secondary side of step-down transformers. It is only necessary to use a choking coil in one of the phases in a three-phase machine. The direct current excitations may be also derived from any separate source. The choking coil may be designed with three limbs, the outer ones carrying the alternative current windings, and the middle one the direct current windings.

PRINCESS SOPHIA WRECK

We are informed by Marine Department officials at Ottawa that a formal investigation into the loss of the Princess Sophia will shortly be held. It is understood that the investigating commission will be composed of the Admiralty Judge in British Columbia, assisted by two assessors, and will be appointed immediately by the Dominion Government.

Washington, D.C.—The reinforced concrete steamship "Atlantus," 3,500 tons carrying capacity, was successfully launched 9 a.m., December 3, at the yards of the Liberty Shipbuilding Co.. Brunswick, Ga.

The "Atlantus" is the first of the concrete ships contracted for by the U. S. Shipping Board Emergency Fleet Corporation, to be finished. Sister concrete ships, as well as a number of concrete ships of 7,500 tons capacity, are being built in the yards of the Liberty Shipbuilding Co., and in four other yards established by the Government exclusively for concrete ship construction.

TYRE ROLLING MILL, LAST OPERATION COMPLETING TYRE

SOME MEANS MUST BE FOUND TO KEEP THE CANADIAN SHOPS BUSY

The Smaller Organizations Should Receive Co-operation and Support Just Now to Help Them Over a Trying Period.

By C. GRAHAM DRINKWATER, Vice-President Canadian Fairbanks-Morse Co.

I see no reason why Canada should not get her share of reconstruction requirements in Europe and at the same time look after her own trade.

The larger industries will take care of themselves, but the smaller manufacturers will unquestionably need assistance in securing orders. The Imperial Munitions Board solved this difficulty in so far as war materials were concerned, and we confidently look to our newly appointed Trade Commissioner to render similar assistance at this time. Such a Board with Sir Charles Gordon at its head can be of invaluable service to Canada. We congratulate the Government on its foresight and trust some business will be forthcoming shortly which can be distributed among our various miscellaneous industries, and help hold our splendid munition organizations together. Otherwise we are facing a period of readjustment, not for big production, but for production on a much reduced scale from the activity of the past four years, and this means labor unrest and small profits from which to pay taxes.

Canada has shown that she has tremendous manufacturing ability, and some means must be found to keep her at work.

THE ADVENT OF A NEW SPIRIT IN INDUSTRIAL LIFE IS APPARENT

By A. L. HAAS

INTENSIFIED by the circumstances of war, change in every direction is rapid. Normally such changes as have been witnessed in the past four years would take generations to effect. Among much that is regrettable and pernicious war has at least one benefit in that it hastens material progress while destroying much that makes life worth living.

Evolution proceeds usually by tentative and slow stages, but the furnace of conflict has a forced draught and while consuming much that can ill be spared does quicken change and accelerate progress in certain directions. Nowhere is this more manifest than in mechanical matters which are the outstanding feature of the last decade and more especially the last four years have seen an unparalleled alteration. Whereas before August, 1914, the machinery salesman had to make great exertions to supplant out-of-date machines by modernized and improved alternatives, to-day the very people whom it took months to convince are themselves seeking diligently for new plant, price being quite a secondary consideration. In place of the salesman trying in every way to convert the customer, the latter now chases the salesman who nonchalantly makes evasive promises.

The reaction of a restricted labor market shows in many directions.

The discontent, murmuring, high wages and independence is one feature which receives much publicity; the other feature is the quickened appreciation of new process, improved method, more efficient machines, the fresh viewpoint on the part of those responsible for production. This has received less notice, but is full of future promise.

The conditions noted are mutual in their effects, high wages, better conditions, plentitude of work, improved mechanism and method are interdependent variables in the formula of production. All previous beliefs have received so rude a shock that greater discrimination in finish, relative accuracy, separation of process, revaluation of relative skill have received extended attention.

The change in attitude is not confined to any one section, it is common to all. Owing to expansion the former private now holds a more responsible commissioned rank in the industrial army, while the opportunity to assume responsibility at an early age has given exceptional chances to youth.

This last factor is of immense importance, for in many directions it has freed industry from the incubus of the experienced, but hide-bound individual tied by precedent and tradition and averse to change. Whole industries have sprung up where the most experienced are still youthful, judged by any former standards.

The new spirit in industry is shown by quickening progress and expansion of the individual; former captains of a hundred now administer thousands and the severe tuition of a time of stress is leaving marks which will influence the future.

It is increasingly evident that industry generally has to be more co-operative in the future, less individualistic. All the reconstruction proposals place this beyond dispute. Co-operation involves everyone affected and it is impossible unless a common atmosphere favors its continuance.

More individual responsibility is required from below as well as greater tolerance from above. The spirit of identity and association to a common end cultivated in school, in national and municipal affairs, and more especially in the realm of sport, form the precedents for the hope of those most interested.

It is to be regretted, therefore, that before trial has been made or a fair chance afforded to the Whitley proposals in England, leaders of labor thought, should have seen fit, to stand aloof and indeed, forbid those under their charge from participation in any scheme of the kind.

To frustrate or afford no trial to a new idea is fatal to progress. Constructive attempts to stabilize industry are not ordinary happenings, for in the ultimate analysis it is ideas which rule, not mere expedients. It is rival ideas which cause disintegration, and the new idea, which is the logical fresh step on the ladder of evolution, cannot be frustrated with impunity. It will eventually defeat any mandate like the tide on the shore.

There is much troublous water to steer through in industrial matters, but the new spirit of high endeavor should suffice to avoid the difficulties. In fact the new spirit is apparent in so many directions that it almost amounts to a new industrial renaissance.

Seattle.—The wooden shipbuilding industry of Puget Sound delivered up to the end of November thirty carriers of 102,600 tons deadweight capacity. An additional 35,000 tons will be delivered by the wooden shipbuilding yards this month, giving them a total of 137,600 tons by the end of the year.

The following list of plants and their tonnage output has been issued by the Northwestern Shipbuilders' Association:

Plant	Ships	Ton'ge
Albina, Portland	7	25,600
Ames, Seattle	10	88,400
Columbia River, Portland	10	88,000
Duthie, Seattle	12	105,000
Northwest Steel	16	140,800
Seattle Construction, Seattle	5	40,500
Skinner and Eddy No. 1, Seattle	27	237,800
Skinner and Eddy No. 2, Seattle	2	17,600
Todd, Tacoma	7	52,500
	96	796,800

The Machine Tool Dealers of Toronto

T. A. Hollinrake, President A. R. Williams Co.

ONE OF THE PIONEERS OF THE MACHINERY BUSINESS

—By A. R. K.

PERHAPS it is only fitting and proper that an industrial centre such as Brantford should send out a lot of men to occupy responsible positions in the industrial and machinery world. Brantford has turned out a number who have come pretty well up toward the top of the heap in various lines. The Telephone City claims T. A. Hollinrake as one of its native sons. In fact, the family home is still there, and Mr. and Mrs. Hollinrake, Sr., are both living.

T. A. Hollinrake is now president and general manager of the A. R. Williams Machinery Co. He first became connected with the firm because the late A. R. Williams considered there was more opportunity for two firms to centralize their efforts than remain as competitors. It came about this way:—T. A. Hollinrake and Robert Kerr established the Canada Machinery & Supply Co. in Brantford about the year 1890, and were doing a nice business in that line. Mr. Hollinrake had a varied knowledge in machine shop and other similar lines, while his partner, Mr. Kerr, had graduated from the Waterous plant, where hundreds of first-class mechanics have entered as apprentices. And so it was that in the year 1894 the Toronto and Brantford firms were merged, taking the name A. R. Williams Machinery Co. Mr. Williams was president, Mr. Hollinrake vice-president, and Mr. Kerr still retains a place on the board of directors.

T. A. HOLLINRAKE
President and General Manager of the A. R. Williams Machinery Co., Ltd.

Mr. Hollinrake is pretty well tied down by the amount of material passing through the Toronto office, but if he had the chance to pick and choose the chances are that he'd get out and sell machinery. For a long time T. A. Hollinrake was known personally from Halifax to Vancouver. He went out after business, and he got it. He knows the lumber country of the North and West, the mining country, the lumbering camps of British Columbia and the mills of New Brunswick. As a matter of fact, men in the business have told me that T. A. Hollinrake went through the Crow's Nest Pass in Southern British Columbia ahead of the C.P.R. Crow's Nest line. He was selling sawmill machinery to Sandy McDougall at Fernie before the pioneers there had decided to call the main street of the town Victoria Avenue. Nor can it be said that he picked the easy trips, either. In the early spring he used to leave Toronto on the long Western trip. In those days there were many districts that had trains only two or three times a week, and selling machinery then meant hard work and lots of it.

But to get back to the business. In 1894 the newly-formed company built the big warehouse and shops on Front street. And just here it might be mentioned that the entire staff in those early days numbered only 35, as compared with something over 200 at the present time. When the Front street property was expropriated for the new Union Station, the Cobban property was purchased on the Esplanade for shops and warehousing purposes, and the head offices, showrooms and supply departments were located in the old Copp-Clark premises, right opposite the new Union Station, which were purchased by the A. R. Williams Co. At that time the only branch of the business was in Montreal.

The growth of the business made it certain that it could not be handled from Toronto any longer. Hence the Winnipeg branch was opened in 1902 to look after the territory between there and the coast. Three years later the Vancouver agency was established, the lines handled there having largely to do with saw mill machinery, log engines and boilers, mining machinery, etc. From this branch an export business with the Orient is conducted. In the East the St. John, N.B., business was established in 1910. An American branch in Buffalo, operating under the name of the A. R. Williams Machinery and Supply Corporation, was opened in 1917.

Speaking to the writer only a few days ago, Mr. Hollinrake expressed himself as optimistic regarding the outlook for 1919 business. That was after returning from a conference of all the Canadian managers at Montreal. "What did we do there?" said the president, in answer to a query. "Well, we sold reconstruction to each other. If the Governments go ahead and make their adjustments quickly, trade should start and move very soon. It would be good policy to remove the traces of war from the machine tool business as soon as possible."

"And how about export?"

"Well, this country ought to be able to get into foreign markets. Just now we are doing a nice business with Japan. We have found it possible to meet the prices of other countries in open competition. If there's one thing that is holding back Canadian trade abroad it is a lack of knowledge of foreign countries regarding this country and its products."

On the death of A. R. Williams about two years ago, Mr. Hollinrake, who had up to that time been vice-president of the company, became president and general manager.

The Machine Tool Dealers of Toronto

Fred W. Evans, Canadian Fairbanks-Morse

HAS DEVELOPED BIG BUSINESS IN TORONTO FIELD

—By A. R. K.

IF one were to inquire for any standing instructions that might be given to the Toronto staff of the Canadian Fairbanks-Morse, it would be a safe guess to say that they could be summed up in two words, "Don't Bluff."

Not that I've ever seen any code of rules posted up around the place, but it's there as plain as any unwritten law can be. And, moreover, one of the company's salesmen told me that such was the sum total of the instructions that he received from the Toronto manager when starting in this territory: "You have a general knowledge of the machine tool trade, but remember, you are going out to meet and deal with specialists in a dozen different lines, and each of these specialists knows his line thoroughly. Never forget that."

But this story isn't so much about the Canadian Fairbanks-Morse Co., as about the Toronto manager, Fred. W. Evans. At the age of 33 he's one of the best known and most successful men in the machine tool business in Canada.

It can't be said that he planned a career for himself in this line. In fact, there's a story in machinery circles that he did, in the truest sense of the word, "break" his way into the business. Some folks set out and work along straight lines to a given point, but the most of us don't, and F. W. Evans belongs to the "most of us."

The old whirligig of fate has a habit of taking people unawares, pitchforking them here and there, and picking out round men for square holes. And after it's all over these men set to work to finish the job that fate started by changing the square hole or fitting themselves to it.

Mr. Evans is a product of Montreal, born there in 1885. He received his early education in the public schools in that city, and on leaving school entered the Grand Trunk shops at Montreal.

He didn't stick. In fact, he found that the opportunities he was looking for were not in that line. And so it was that, after a course in business college, he entered the office of Fairbanks-Morse as a clerk in 1904. And here's where he "broke" into the machine tool line.

In the Montreal office was a particularly fine Brown & Sharpe miller, and Evans had often admired the thing and had more than once given a turn to the feed levers. This turning process was continued to such an extent that one day the limits of the machine were exceeded and something snapped. At that time Mr. Rudel, now of the Rudel-Belnap Co., was in charge of the machine tool department of the Fairbanks-Morse Co., and that particular B. & S. miller was some pumpkins in his eye. So when he saw his pet hobby broken he drew up the siege battery to shell out the victim. After the bombardment had produced no results, the boy Evans walked into his office and told how the B. & S. machine had been put on the blink. But Evans wasn't canned. In fact, a strong feeling grew up between Rudel and the clerk, and it wasn't a month after before he had taken him into the machine tool department. From then on promotion came quickly. He was assistant manager, machine tools department, 1909-1910; manager of the department, 1910; manager of the Winnipeg branch, machinery department, 1910-1914; manager of the machine tools department for Canada, Montreal, 1915; transferred to Toronto, 1915; general manager of the Toronto business since 1916.

FRED W. EVANS

Toronto manager of the Canadian Fairbanks-Morse Co., Ltd.

Particularly during the duration of the war has the Toronto business of the Fairbanks-Morse Co. developed. I happened to mention this fact to Mr. Evans one day, but he simply admitted the fact, and stated that he was the victim of favorable circumstances. When it comes to talking, he can talk business and trade, bowling, motoring—yes, and a bit of Liberal politics as well—but when it comes to talking about F. W. Evans, well, as a space-filler, he'd starve.

Speaking of business, Mr. Evans has strong views, and these are also held by his company. "Just now we are receiving a number of requests from all over the country to buy in equipment that has been used in shell shop work. We won't touch it. Our policy has been all through to encourage the sale of new machinery. It's better all around. We'd rather do less business for the present than be very busy taking in second-hand machinery. Selling new machinery forms the basis for good, clean, square business with very little come-back to it."

Since coming to Toronto, Mr. Evans has taken an active interest in several undertakings. He is a member of the Canadian Manufacturers' Association, Toronto Board of Trade, and of the Ontario, Rotary and Empire Clubs. In 1910 he was married to Miss Edna Hurd, daughter of Dr. J. E. Hurd, Toronto. The Evans home is 19 Oakmount Boulevard, Toronto, where two young men rise up and salute F. W. as "dad."

The Machine Tool Dealers of Toronto

The Garlock-Walker Machinery Company

TWO SUCCESSFUL SALESMEN JOINED FORCES IN 1916

—By A. R. K.

LANDING in New York at the age of 14 with $1.48 in his pockets, reads something like the start of a romantic business career. I don't know if the amount is correct to the cent, but it's pretty close to it. Just how he got along for the first few weeks or months I've never heard, but he always put in a lot of spare time studying, and it was not very long before he was fairly well versed in shorthand. In fact, shorthand, and a desire to some day study law, seems to have been the tandem in which most of young Garlock's ambitions were riding at that time.

That's a few years back now. William Garlock was born in Oswego, on April 17, 1882. He's now president of the Garlock-Walker Machinery Co., Toronto, one of the firms that has forged ahead rapidly during the past five years. But just before we forget it, there's a story concerning those early New York days that deserves printing. The chances are Mr. Garlock will wonder where CANADIAN MACHINERY heard of it. But here's the story as I heard it:—

One of his first positions was as stenographer in an office. Wages $5 per—board $4.50 per—balance 50 cents per—week. The "boss" intimated that he was going to Denver for a couple of weeks or so and Garlock, Jr., was to look after things in general. In fact, he was at the office with the boss the night previous to his departure getting final instructions. The stenographic department of the office (consisting of W. G.) turned up as usual the next morning, and found things dull. After lunch—shoebox kind—things were likewise dull, and the stenographic department of this New York office decided that it was time to act like any other real office man. So he dusted off the boss' pet sign and got it ready for action. It read "Out—Back at 5.30." So without any more preliminaries the sign was displayed on the outside of the office door. We've clean forgot what the score was at the ball game that afternoon, but 'long about 5.50, true to the promise on the shingle, Garlock, Jr., returned to his place of business, just to make sure that it hadn't departed. But there had been some tinkering with that billboard in the meantime. The hang thing had been taken down, the door was open, and the boss was on the job. The $5 a week job passed to other hands.

A strong preference for studying law probably turned him to his next position with a New York legal concern. By that time he was an expert stenographer. That was, if my dates are right, about 1898. For six years he worked as law clerk, hunting up evidence and securing all the necessary preliminary training for the legal profession. In fact, if he were to leave the machinery field now, my best guess would be that he'd turn to law even yet. A breakdown in health settled this, however, and in 1905 he entered the sales offices of the American Woodworking Machinery Co. This company, although located at Rochester now, was then in New York. There wasn't much spare time in those days. Mr. Garlock taught shorthand three nights a week in a Y.M.C.A. night school—the other three he studied and tutored with university students. Promotions came rapidly, and by the time he was ready to open the Canadian field for his company, he was sales manager of the eastern division, in charge of a sales staff covering 15 states.

WILLIAM GARLOCK, JR. ALBERT B. WALKER

It was on the first of May, 1913, that Mr. Garlock came to Toronto to open the Canadian branch of the American Woodworking Machinery Co. The results were not entirely satisfactory, and the company decided to close the Toronto office. William Garlock did not see things that way, and he decided to stick on his own account. When Canadian firms started to make munitions he turned to metal working machinery as well. His first order was for $100,000, and he at once placed his orders mostly with American concerns. Two weeks later the order was cancelled. It was up to Mr. Garlock to cancel also or sell. He decided on the latter course. He had sixty days to swing the deal. Strenuous days, those, but to make a long story short, he sold and delivered the whole consignment.

It was on the first of January, 1916, that the firm Garlock-Walker Machinery Co. was formed. Albert B. Walker, known to many in and out of the trade as "Doc," took over the metal working end of the business. And he comes honestly by that name of "Doc," for he practised medicine for five years in Michigan, after graduating at Detroit. Mr. Walker retains a strong liking yet for the profession, but it was poor health that forced him out. As a matter of fact, I belive I'm right in stating that he volunteered for service in the recent war as a doctor with the U.S. Army, but was not called.

Mr. Walker is an old Toronto boy, but the family moved to Galt, where he went as far as matriculation in school work. Entering the Goldie-McCullouch shops when David Hastings, now general superintendent, was foreman of the machine shop, he served his apprenticeship as a machinist,

Continued on page 770

The Machine Tool Dealers of Toronto

A. E. Juhler of the Rudel-Belnap Company

STARTED IN MACHINE TOOL BUSINESS IN EUROPE

—By A. R. K.

REFERENCE is often made to firms that have "long and honorable careers." Evidently this country is not old enough yet to boast of the real thing. Perhaps we imagine that some of our concerns that have been in business for fifty or sixty years have a right to be thus listed, but when other records are looked into, this young country's record looks of the amateur type when it comes to years.

For instance in Copenhagen there is a firm handling American machine tools and supplies under the name of V. Lowener. That house has been established for over 250 years. They command a wide patronage covering practically the whole north of Europe. It's hard to say what changes the war has made in this regard. But to get down to the story. Some thirteen years ago a young American became connected with the firm, after having spent some years on the continent for the Bethlehem Steel Corporation. He's a resident of Toronto now, living at 89 Delaware Ave. His name is A. E. Juhler, Toronto manager of the Rudel-Belnap Machinery Co.

If my information is correct, Mr. Juhler is a native son of some spot in Southern Ohio—as a matter of fact it's doubtful if the place is recognized by the map makers. It might be said that his whole life has been so far spent in work closely allied with machinery, engineering and allied projects. Graduating from Lehigh University in 1892, he had hardly ceased being a sophomore when he got out and went to work to apply what he had soaked up at school. Mr. Juhler had specialized in factory engineering, which included mechanical lines and an extra amount of chemistry just to keep him busy. He didn't start with any two by four concern either, but hitched up to the Standard Oil Co. in the construction and operation of plants, being first located at Whiting, Ind. His work with the Standard Oil Co. also took him to Europe a number of times.

A. E. JUHLER
Toronto Manager Rudel-Belnap Machinery Co.

It was in the year 1903, that Mr. Juhler went with the Bethlehem Steel Corporation, going to Europe exploiting the Taylor-White tool steel patents. This took him through Northern Europe time after time, and brought him into very close contact with the mechanical developments and ideals of nearly every country on the continent. The introduction of these tool steel patents, and their adoption in more centres naturally led to a realization of the need for better machine tools with which to use the high speed steel, and it was really from this that Mr. Juhler entered the machine tool business with the V. Lowener Co., at Copenhagen, making a specialty of American machine tools. The writer once discussed with him the various points where Europeans excelled and failed in the production of machine tools, and it was apparent that he had seen a lot and remembered most of it. In fact, he had quite an admiration for some of the wood working machinery that was turned out in Sweden, claiming it to be superior to anything that was being placed on the market at that time.

Returning to this side of the Atlantic, some 12 or 13 years ago, Mr. Juhler was identified with various machinery houses and engineering concerns, living at Montreal, Hamilton and in Toronto for the last six years. He came here to establish the Toronto branch of the Rudel-Belnap Co. But he was in Canada some years before his connection with this firm. It was the building of the Imperial Oil Co. refineries at Sarnia that first brought him to this country. There's one thing worth mentioning in connection with this contract. The cutting up the holes for the tanks was in charge of Wm. Stokes, who shortly afterward had charge of most of the actual drilling and digging of the St. Clair tunnel, under the direction of the engineer, Mr. Hobson, father of Mr. Robert Hobson, now president of the Steel Company of Canada.

Since the opening of the Toronto branch, Mr. Juhler has met with success. There has been a lot of business handled in the rather modest suite of offices on Adelaide St. West. Apparently they have handled a select line, as reports at the head office in Montreal will show that there hasn't been a dollar lost in bad accounts at the Toronto office in six years.

"We have very clearly defined policies," remarked Mr. Juhler, "and we try to adhere very closely to them. The lines we handle are controlled by us here. If a customer wants a lathe for instance, we can present only one make to him. If he wants a grinder or a drill the same thing holds true, likewise with a planer. We find that specializing in this way is quite satisfactory. Our selling prices, also, are limited by the selling price at the factory. We have never made a practice of going into used machinery. The war period brought us a lot of very satisfactory business, both in Montreal and Toronto."

Like many another enthusiast in his business, Mr. Juhler enjoys the day when he finds it possible to get away from the office and get after orders outside, and one of his "regrets" at the increase of business is that it is making it necessary for him to spend more of his time in his office.

THE GARLOCK-WALKER MACHINERY CO.

Continued from page 768

afterwards gaining experience with their sellin~ force. It was shortly after this that Mr. Walker started the study of medicine, in the summer months working on the sales staff of the H. W. Petrie Machinery Co. A siege of sickness followed his five years' medical practice in Michigan, and he was forced to abandon this life. Returning to Canada he joined the A. R. Williams Machinery Co., going from there to the Canadian Fairbanks-Morse Co. For eight years prior to forming his present partnership he was with the H. W. Petrie Co., having spent in all some 15 years as a machine tool salesman.

Mr. Garlock, the president of the firm, believes the machine tool dealers should work much closer together, especially at present. Speaking to CANADIAN MACHINERY on this point not long ago he said: "It would be better for the dealers to have a uniform policy regarding the disposal of shell plants. Many purchasers now will meet dealers with a proposition to take over a certain amount of their shell shop equipment on the sale of new goods, and if the dealers would arrive at some definite understanding it would do much to simplify the whole situation."

Mr. and Mrs. Garlock and daughter live at Ernscliffe Apartments, 197 Wellesley St., Toronto. Mr. Garlock, in spare time, fishes and plays golf, although fishing for business has been his chief occupation for the last four years.

THE PROBLEM OF THE SMALL SHOP WILL NEED CLOSE ATTENTION NOW

By T. S. Worthington, Montreal

RE-ESTABLISHMENT of normal activity during the post-war period is already engaging the attention of politicians, business men and captains of industry. The share Canada will have in the reconstruction programme is, as yet, very uncertain but depends in no small measure on the capacity for prompt action in securing for herself some of the business she is justly entitled to, but for which she will have to scurry in common with other countries.

What Canada has achieved in the production of munitions and the manufacture of different classes of material and war equipment, is ample evidence of her ability to take on and carry to a successful conclusion almost any line of industrial enterprise. Co-operation of the Government and representatives of large commercial and manufacturing interests is even now at work to obtain for Canada some portion of the rehabilitation activities that are absolutely essential to European prosperity.

It is beyond question that this country will have energetic competitors for a large proportion of this prospective foreign trade, and it is imperative, therefore, that every effort be made to advise and influence the European buyer that Canadian industries are in a position to supply virtually every need in the rebuilding requirements of the various manufacturing and mining centres destroyed, or other devastation by the unprecedented destructive warfare of the past four years.

One of the features of after-the-war development, or even continued activity, that has probably received little attention or consideration, is the outlook of the host of small machine shops and manufacturing plants the increasing co-operation of which has made possible the remarkable achievement in shell production of many of the larger industrial establishments. What will be the position of these small plants during that period of reconstruction that is certain to follow on the heels of the recent war, the destructive agencies of which have never been equaled in the history of the world? Will these small plants be isolated from the opportunity to participate in this work of reconstruction? Will the initiative of the larger interests react on those who are apparently dependent on the growth of the big concern, or will the little fellow reach out and secure for himself some of that European business which will go to the parties first in the field and in a position to perform the work?

Different agencies are now at work both in England and on the Continent to obtain business for Canadian industries. Many of these will be instrumental in landing their objective, but no assurance is given that the little fellow, who has faithfully performed his allotted task in the heat of war emergencies, and who may now be patiently waiting for some portion of foreign business, will share in any orders that may be placed here for European markets. The necessity for widespread distribution of contracts after the war will be less pronounced than when every available plant was working on war essentials, so it is not unlikely that fewer subcontracts will be the order of the day after peace is finally restored. It therefore seems imperative that the smaller interests should leave no stone unturned that might unearth some means of maintaining their plants in a healthy working condition.

A proposition that has been advanced by one of the business men of Montreal, and one that is interesting a number of smaller manufacturers and machine shop managers is the co-ordination of the various small interests for the purpose of sending responsible men to England, France and Belgium, and endeavor to obtain business that in the ordinary course of events would probably be overlooked by the larger interests. It is believed that many small manufactured articles will be required in the war-ridden countries, and the magnitude of these requirements in the aggregate will not be sufficient to stay the interest of those now on the trail of big business. It is the opinion of many that some co-ordinate representation, by men closely conversant with the every requirement of these countries and also the traits and desires of the people themselves, could secure sufficient trade to more than repay the initial outlay required by those firms associated in the venture.

BITUMENS FOR INSULATING CABLES

Of the few varieties of bitumen having the requisite elasticity and hardness for use as insulators for electric cables, elaterite is the best known. Since, owing to the war, this is no longer procurable in Germany, attempts have been made to prepare substitutes ("insulation tar," "insulation masses," etc.) by incorporating up to 40 per cent. or more of kaolin, chalk, etc., with natural or artificial bitumens having a dropping-point (melting-point) of about 40°-60° C. Such addition, however, only retards the flowing of the mass at higher temperatures, and cables insulated with such materials lose their shape as certainly, though not so soon, as if the unfilled bitumen were used. The improvement of ordinary bitumens, asphalts, pitches, etc., so as to raise the dropping-point, while retaining their elasticity and ductility, can only be effected by a deep-seated chemical alteration of the bitumens. For example, if the mineral matter is made to combine with the bitumen as in Schon und Co.'s patent process (not yet published), the dropping-point of a bitumen may be raised from, e.g., 41° C. to 115° C. The so-called "original Trinidad asphalt epure" has a dropping-point of about 105° to 115° C., and contains about 30 to 40 per cent. of mineral substances, but, owing to their reduced elasticity, these products cannot be used as the permanent basic material for cable masses, and are, at best, only suitable for admixture with elastic bitumens of lower dropping-point. The second method of raising the dropping-point is by chemical treatment of the bitumen without the addition of mineral matter. Only first-grade bitumens are suitable for cable masses, viz., those with the requisite elasticity, ductility, and adhesiveness, and a dropping-point of at least 75° to 95° C., whilst if the "semi-bitumens," including natural or artificial tars, asphalts, petroleum, pitch, etc., with a dropping point of 40° to 60° C. be used, the cable mass will lose its form when exposed to an external temperature of 20° to 30° C. (Dupré Chemiker-Zeitung, 1918.)

Large Offices for Railway Board.— Elaborate district offices for the Canadian Government Railways are to be established in the Great Northwestern Telegraph Building at the corner of Sparks and Metcalfe Streets, Ottawa.

WHAT OUR READERS THINK AND DO

Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity

SOLID PORTABLE VISE

By D. A. M.

THE photo shows an excellent arrangement for a vise and bench that may be wanted in different parts of the shop to use in assembling operations. The bench in this case consists of the legs and top casting formerly a part of a special machine. After the work for which the latter were built was completed the machines were scrapped, but half a dozen of the leg-and-top sets were kept for some possible future

SOLID PORTABLE VISE.

service. That service soon appeared when vises were needed for the floor hands on an erecting job. Bolted to such benches the vises were secure enough for any ordinary vise work as the benches alone weighed 200 lbs., but it was still possible to slide them along on the concrete floor to some new location. The true planed top casting made an excellent surface plate, which was of additional help to the workmen.

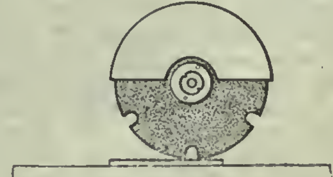
NOTCHED EMERY WHEELS

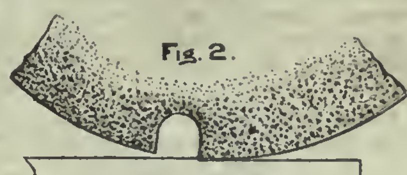
By E. N. D.

Very considerable expense and trouble was experienced by surface cracks developing upon the ground surfaces of hardened thrust washers, flat high speed steel cutters, etc., after having been surface ground.

The varying thickness of the work in question did not appear to make any difference and many schemes were adopted, including the use of wheels of different grades, varying the peripheral speed, etc., but to no purpose. As many, if not more, theories were advanced as to the probable cause, but no reason could be definitely decided upon, neither could a satisfactory method be arrived at in order to eliminate the trouble. Finally, the writer hit upon the idea of notching the wheel in six or seven places, thereby producing an emery wheel with a milling cutter's characteristics, in addition to which these notches acted the part of a fan, and immediately displaced all the small cuttings as soon as they were released, which no doubt were the cause of overheating and subsequent trouble. However, whatever the real cause was, the real cure proved to be these notches in spite of the strong opposition they met in the early stages.

Whilst the writer did not go very deeply into whys and wherefores, it may be of interest to note the following figures: With a one-eighth feed, and a cut of .009 in., there was no heat generated whatever, whilst with a one-eighth feed and a cut of .015 in there was only the slightest discoloration, imperceptible rise in temperature, and positively no surface cracks. Furthermore, there was a marked improvement in the class of grinding done, whilst the wheel did not glaze half so quickly, neither did they require dressing so frequently. Referring to the drawings, Fig. 1 shows a general arrangement, whilst Fig. 2 shows more clearly the method of notching. The idea is by no means new, but for some reason or other is not nearly so universal as it might be. The notches referred to in this article were made in a wheel 8 in. diameter, with a 1 in. face, and were made approximately ½ in. wide and ¾ in. deep. Some of the leading manufacturers prefer to have these notches made at an angle of about 45 degrees, though for all ordinary purposes a notch made approximately square with the face will be found to give very satisfactory results indeed.





FIGS. 1 AND 2—THE USE OF NOTCHED EMERY WHEELS.

AN EMERGENCY REPAIR JOB

By J. DAVIES

The shop lathe was on a rush job when burr-er-er went all the teeth off one of the feed wheels. On examination it was found that it was a 10 pitch gear with 67 teeth. By no process of mathematics known to us could we fix up the milling machine to cut this gear accurately, since we lacked the one thing necessary: an index plate with a 67 circle, or multiple of 67, as this is a prime number and could not be divided. What the milling machine hand had to say about manufacturers making gears with prime numbers would not look well in print. It was impossible to wait while we sent to the makers for a new gear, so we had to cut the gear as near as we could. This is how it was done: This machine, like most milling machines, required 40 complete revolutions of the indicator on the worm shaft to turn the gear between the centers once round, so no matter what circle is used on the index plate, or how many teeth required, the indicator must pass entirely round the chosen circle 40 times before the job is finished. From this fact the following rule is deduced: The number of holes in the chosen circle multiplied by 40 will always equal the total number of holes that the indicator passes in cutting any gear, and the total number of holes, divided by the number of teeth, will equal the number of holes for each tooth. The nearest circle that we could get on our index plate was 66, so that 66x40 = 2640 holes used altogether in doing the job. The dia. of a 6.9. The circumstance is 6.9x3.1416 = 6.3. The circumference is 6.9x3.1416 = 21.677, so that one hole would turn round the work

$$\frac{21.677}{2640} = .008.$$

to the nearest thousand. The job cannot be done absolutely correct with a 66 circle, as it would require

$$\frac{66\times40}{67} = 39\frac{27}{67}$$

holes for each tooth; by using 39 holes the error would be

$$\frac{27}{67}$$

of a hole or

$$\frac{27}{67}$$

of .008 about .003 per tooth. This would be near enough for all practical purposes if it were not for the fact that the error accumulates as we go round the wheel. This can be compensated for by going an extra hole now and again, instead of using 39 holes all the time use 40 for some divisions.

It has been shown that 39 holes leaves us about .003 short of an exact division, and that from one hole to the next moves the work round about .008 thousands, so that when our accumulated error was nearly .008 thousands we moved round an extra hole, so that by care the greatest error on any tooth was not more than .005 thousand, measured on the circumference of the gear. This was a negligible amount and could not be detected with the eye.

When forced to cut a gear by approximation like this, the actual error at any tooth may be calculated as follows:

Find out how much your job turns round by moving your indicator one hole; this will always be circumference divided by number of holes in chosen circle x40, thus

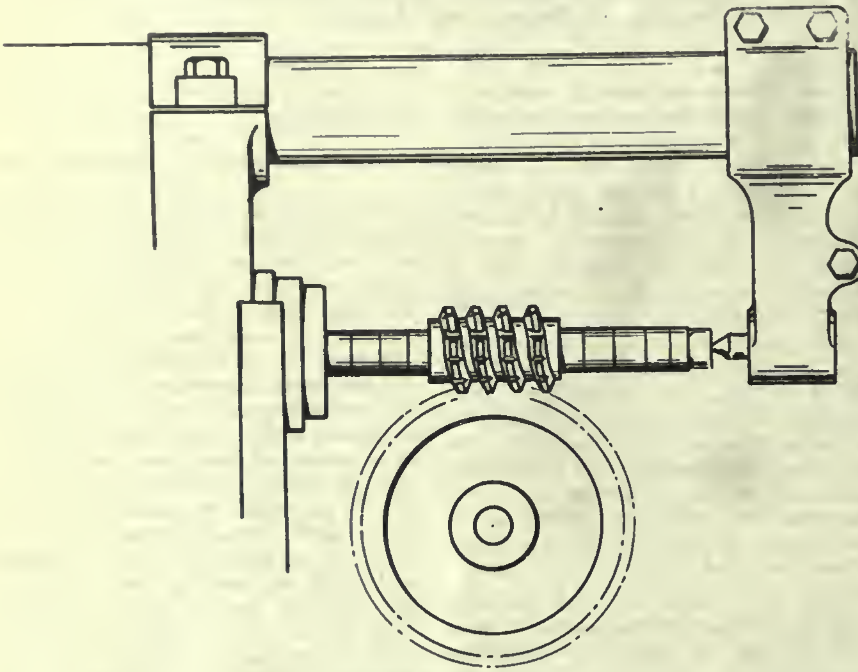
$$\frac{\text{Circumference of work}}{\text{No. of holes in circle x40}}$$

Suppose you want to find the accumulated error at any tooth, calculate the correct number of holes that should have been used according to rule given above; then count the holes actually used; then compare the difference of the two by the amount each hole represents. This will give the accumulated error at any tooth in the gear.

AN EMERGENCY HOB

By "TYKE"

A dozen bronze worm whels about 9 ins. diameter had been turned, but on account of there being no suitable hob



IMPROVED HOB

in the shop, it was arranged to send them out to be cut. A gauge was made for the worm, a dozen of which were required, and these were all finished before the worm wheels put in an appearance. When the worm wheels arrived they were duly checked and found to be shy in depth of teeth by approximately .029 ins. Had these been returned to the firm that cut them there would have been an unavoidable delay which would have disorganized the job rather more than was bargained for, the result being that it was agreed that a sufficiently good job could be made of them by hobbing them all with the worm that was to have been used with them. One of these was fluted, backed off by hand, and since it was made of machined steel, it was case-hardened very carefully, then touched up with an oil stone, and mounted on an arbor, as shown by sketch. After running one off, it was carefully checked and found to be very close to what was required, the remaining eleven being cut in exactly the same manner, and in each case they came off the miller a really first class job. In concluding, it might be stated that, due to this experience, it was a common occurrence thereafter to make up small tools, such as reamers and milling cutters of machinery steel case-hardened, providing the metal to be worked was one of the softer kind, such as brass or aluminum. For odd jobs, these very cheap tools had this advantage, when the job in question was finished, there was no serious loss in discarding them, neither was there the tendency to stock up unlimited numbers of these tools, which one so frequently sees, when they are made from cast steel or high-speed steel.

A UNIQUE LAPPING BLOCK

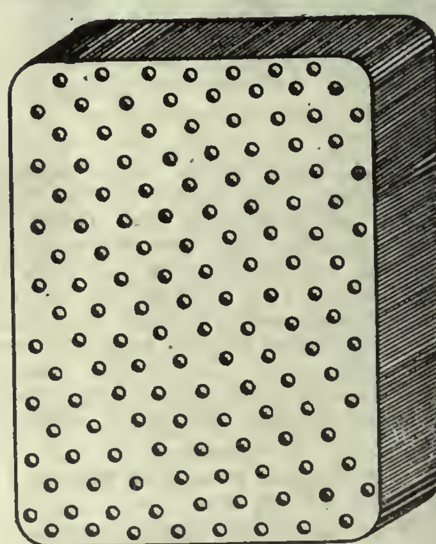
By "TYKE"

Some years ago the writer had occasion to make a small lapping block, and as the job to be done was wanted in a hurry and there being no shaping machine available, it was very necessary to utilize some other means of producing a very flat face together with the necessary cutting edges as it were. This was done by facing a piece of cast iron in the lathe in the usual way, but instead of cutting the usual chequered grooves, the block was laid out for a series of diagonal holes as shown by the accompanying sketch. These holes were drilled about half inch apart, one-quarter of an inch deep and one-eighth of an inch in diameter. The result with this emergency lapping was so very satisfactory that the holes were finally drilled completely through the block, which was kept in constant use, and in good shape by refacing from time to time.

EFFICIENT HANDLING WITH A LOW COST TRUCKING SYSTEM

By D. A. H.

There is a need in almost every plant for some sort of a shop truck between the elevating truck with its movable platforms and the common two-wheeled hand truck. In manufacturing establishments, there is a field for a truck



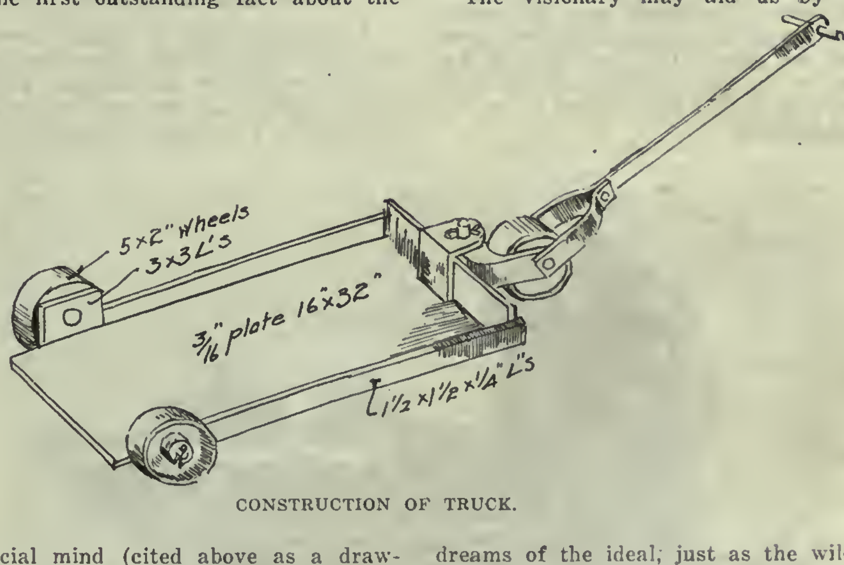
AN IMPROVED LAPPING BLOCK

to supplement the elevating truck on work carried through in smaller quantities that does not warrant or is not adapted to the latter. Often the work in one department is such that the elevating truck and platforms are too bulky for the parts produced, but some form of conveyance is needed, needed badly for the parts, either just in that one room or for inter-department haulage.

A form of truck used most successfully in one machine shop isd shown by the drawing. It is made of steel throughout with the exception of the wheels, which are cast iron. The platform is a piece of sheet steel stiffened by angles, and angles are riveted on to support the wheels. Such a construction permits a low-down platform that facilitates loading. The truck is designed for a total load of 500 lbs.

TRUCK IN USE IN THE SHOP

The class of work in this particular shop is of such a form that the parts are most easily kept in kegs or similar receptacles, and in boxes about a foot square. All of these containers are kept on the floor and the work at benches and machines is arranged so that handling the parts is most efficiently done in this way. The loaded containers weigh about 159 lbs. each, and some means of handling within the strength of the floor boy was imperative. These trucks proved to be the means. Being so low down, a box or keg could be tipped and rolled into place single handed, with no danger of spilling the contents, or need for a skilled workman to "give a hand." A total of about an hour's work a day on the part of the boy was sufficient to do all the trucking of several hundred containers in a department.



CONSTRUCTION OF TRUCK.

MECHANICAL JURISPRUDENCE

By A. L. H.

To the engineer involved in some question subject to the arbitrament of law, the facility with which the trained legal mind making a specialty of industrial cases will handle an engineering problem is surprising. Like the seaman witness questioned by a well prepared counsel, who reciting the facts preceding a collision put a definite query to receive the unexpected and surprised answer, "Why, gov'nor, you must have bin there," the engineer witness is apt to be quite as startled under cross examination. The boilermaker forean who asked in an audible voice as to "who that feller was talking to the judge" raised a smile in court by denying in an equally audible way that he was a lawyer and must be a boilermaker, and so paid a high compliment to the late Lord Alverstone.

There are many occasions upon which an engineer must exercise judicial qualities quite apart from courts of law; indeed, every man whose business is of material and human compounded must consistently exercise the faculty supposed to be peculiar to wig and gown. From the refractory customer determined to complain to the latest grievance of the casual laborer, tact and discrimination no less than more technical qualities are needed.

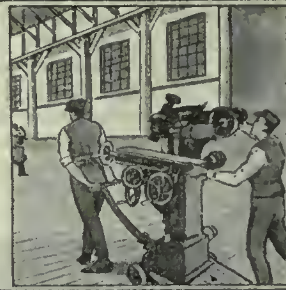
One of the drawbacks of the nicely poised judicial mind is that it sees too clearly all sides to a question, while the legal profession are notorious for the ability to produce some argument for the worst possible case.

The first outstanding fact about the judicial mind (cited above as a drawback) is essential to the engineer; without it he cannot sift evidence. The second factor above seems to be a well established shop phenomenon, for one asset of the mechanic is a good, sufficient and cast iron excuse for anything called into question by foreman or manager. The mechanical expert in a consultative capacity has to be judicial; as a matter of fact he does his best to look the part, while a late judge's definition of prevarication placed the expert witness in the lowest category.

The purchase of a new tool, of power plant, the engagement of men, the question of management itself all involve this mater of judicial faculty. It is necessary first to see the whole question, obtain all the evidence, come to a decision in face of rival claims, it is a matter of judgment; all portions of jurisprudence. The mechanical man may be less inclined to argument, may be more deductive, more intuitive; but judicial he must be, for his trade is one of the most complex in modern industrialism. When a case gets out of technical hands to the public judgment seat, it is a pretty bad case as the lawyer finds out. The inventor is rarely judicial in spirit relative to his particular project, and real criticism itself is the exercise of judicial faculty. No one will question but that the average engineer is a good critic. He is at times apt to forget that although there may be many alternatives there is usually only one course expedient. Here, however, we arrive at another question altogether, since justice and expediency are not the same. Witness the difference between law and politics, the latter purely a question as to what is expedient. There may be a sense in which the wider problems of labor, organization and vexed trade questions are matters of industrial politics, but with these for the moment we have nothing to do. It might, however, be useful to remark that just as in more general connections, justice and expediency are only nodding acquaintances. So in industrial matters it is the expedient which is practical, not the absolute.

The visionary may aid us by his dreams of the ideal, just as the wilder inventor may see where we are blind; but both neglect practical limitations and neither formulate something which can be put into terms of reality. Jurisprudence concerns itself with enactment and interpretation. exactly as the engineer must face his daily problems of complex aspect in its spirit.

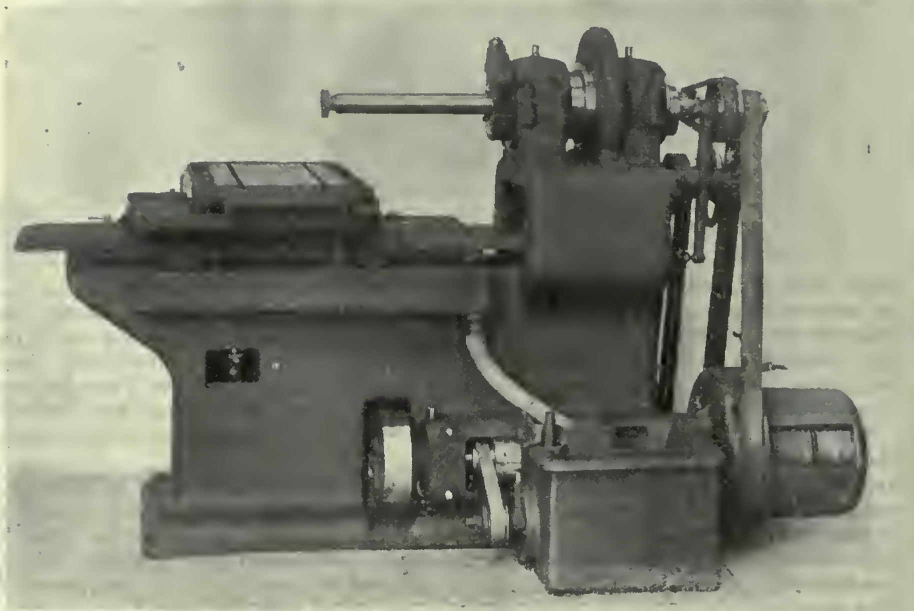
DEVELOPMENTS IN SHOP EQUIPMENT



Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.

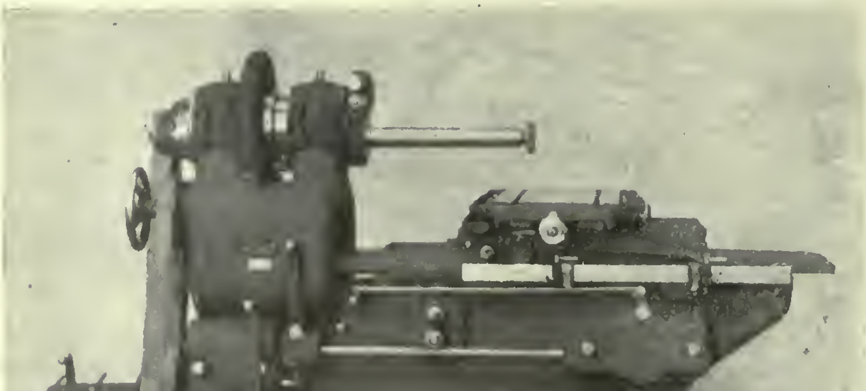
CYLINDER GRINDER

THE accompanying illustrations show a new cylinder grinder No. 65, manufactured by the Heald Machine Co., Worcester, Mass. This machine embodies a considerable number of improvements over the preceding or original machine No. 60. Instead of mounting the work table on a slide having vertical adjustment on the face of the columns, both the eccentric grinding head and work table are supported on a solid bed. This change secures a more rigid machine for supporting heavy castings, and at the same time allows as much vertical adjustment as is actually needed in general manufacturing practice. In a large majority of the plants using cylinder grinders the work table is not adjusted vertically in operating the machine, except when a very slight vertical movement is necessary for truing up a bore, which has been machined a little high or low. The work table of the new machine has a vertical adjustment of ⅛ inch to allow for whatever vertical changes may be needed when grinding castings containing more than one bore. The work-holding fixture for the new machine can be easily arranged to hold the cylinder at the required height.



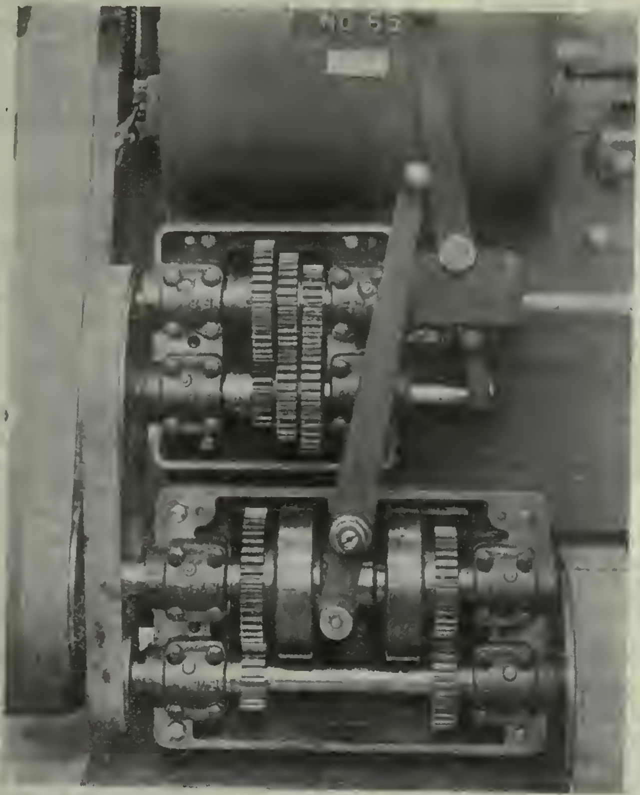
REAR VIEW OF GRINDER SHOWING WATER CIRCULATING ARRANGEMENT

An inclined slide is located between the main table and the cross feed table, which permits of the vertical adjustment. As this intermediate slide is adjustable in a direction parallel to the main slide, it moves either up or down the inclined ways on the main table, thus raising or lowering the cross slide table and the work. A hand crank turning the shaft and connected through bevel gears with a screw operates the intermediate slide.



CYLINDER GRINDER

One of the interesting features of the machine is the method of arranging or supporting the dogs, which control the travel of the table. These dogs are not attached to the main table in the usual manner, but are carried by a dog-bar, which is supported by the intermediate slide, which provides the vertical adjustment. The advantage of this construction is that the travel of the grinding wheel relative to the work is not changed by an adjustment which may be made for raising or lowering the work. The illustration showing the end view of the grinder is indicative of the excellent design of the machine. The driving mechanism there shown is another interesting feature of the machine, and differs somewhat from the arrangement used on former machines of this company's make. The main drive shaft is driven either directly from the main line shaft or from a motor, and is mounted at the rear of the machine near the base. The machine shown in the illustration is arranged for a line shaft drive—tight



GEAR BOX DETAIL

END VIEW. SHOWING DRIVING MECHANISM

and loose pulleys being provided so that a countershaft or overhead works are not required. In the case of a motor drive a single belt pulley could be employed. The grinding spindle is driven from the main driving shaft through a flexible idler, one belt connecting with the idler and another belt transmitting motion to the grinding spindle. The tension of these belts is maintained automatically by an ingenious arrangement which may be seen by referring to the end view. The tension of the belt leading from the main driving shaft is controlled by an idler, which connects with a lever which, being pivoted in the centre, carries the idler pulley upwards and maintains whatever tension is required.

The speed of the wheel spindle is changed to suit different diameters of grinding wheels by means of interchangeable pulleys, which are applied to the wheel spindle.

The gear boxes are located at the left-hand side of the machine. The lower one provides two speed changes for the eccentric head, these speed changes being controlled by a lever, which operates friction clutches of the expanding type. A cross-belt connects this speed regulating box with the main driving shaft at the rear.

A double cone of gears is contained in the upper feed box and a sliding spline provides for different rates of speed, or speed at which the work can be fed past the wheel. These changes are controlled by a lever. The automatic reversing mechanism of the machine is connected with this feed box by a shaft which extends along the front of the machine.

The main table is equipped with limit stops which automatically reverse its travel at the extreme end of the stroke, so that it is impossible for the operator to run the table rack out of mesh with the driving pinion. All the control levers for this machine are within a radius of 18 in., so that the operator may reach any one of them with the least possible effort and without stooping. The same double eccentric head which is used on the company's No. 60 machine is used to carry the grinding wheel spindle of the new machine. This eccentric head has a micrometer adjustment for readily varying the diameter of the hole being ground, and also the automatic adjustment which can be made to operate at each revolution of the eccentric head. In order to secure greater rigidity, especially for the grinding of large cylinders containing 4 or 6 boxes en bloc, the base of the machine has been widened considerably. The ways on which the main table slides are of the dovetail form, and a gib is provided on one side so that all play can be eliminated.

The lubricant pump is driven by a pulley from the main driving shaft at the rear, which also has a pulley for running the exhaust fan in case the machine has an independent exhaust system. The work table and intermediate slide are arranged to catch the lubricant, which flows to a channel or trough at the rear of the bed, and then put into the pump tank. The cover of this tank has several compartments or partitions so arranged that most of the sediment is removed before it enters the tank.

ROTARY SURFACE GRINDER

The 16-inch rotary surface grinder shown in the illustration on page 776 is the latest development of the Persons-Arter Machine Co., of Worcester, Mass.

The 16-inch size has been designed to meet the demand of manufacturers for a machine of greater capacity than the 8-inch and 12-inch models now made. These machines are admirably adapted for the rapid and accurate grinding of such work as piston rings, circular saws and knives, bearing races, valves, dies, discs and the like.

The 16-inch model is equipped with a Persons-Arter design, high powered magnetic chuck 16 inches in diameter. The machine, however, has a capacity for work up to 17½ inches in diameter and can swing work 21 inches in diameter with wet equipment and 24 inches with dry grinding equipment. The chuck on the machine can be loaded with small pieces, and within its capacity, the machine is capable of handling the same class of work as usually given to a rectangular surface grinder, thus the machine can grind rectangular work to a limit of 8 by 16 inches. The vertical capacity of the machine is 10 inches with a full diameter grinding wheel, while work of greater thickness can be ground with a small wheel.

The illustration shows the front view of the machine, the strong and rugged construction necessary to superior grinding machines being very noticeable. The massive wheel head slides in one "V" way and one flat way, thus ensuring a true movement.

Its travel can be controlled by a hand feed or automatically by dogs mounted on a rack, which can be instantaneously moved and set for any length of stroke desired, the minimum stroke being ½ inch. Minute adjustment is made by means of screw controlled pawls on these dogs.

The wheel spindle, 2 3-16 inch diameter, is made of chrome nickel heat-

ROTARY SURFACE GRINDER

treated steel and runs in large bronze bearings. These bearings are of the split tapered type, thus providing for take-up in case of wear. The spindle and its bearings are carefully protected from dust for the full length, and are easily adjusted. A solid pulley is mounted on the spindle and this, with a spring controlled idler applied to the driving belt, makes a good smooth drive and so materially helps to keep the work free from chatter marks. The belt position, it will be noticed, is set forward on the wheel slide, a distinctive feature which offsets the wheel from lifting when traversing the work.

The wheel slide is automatically controlled by a single tension spring reversing mechanism. On the shaft, on which the three step cone pulley seen is mounted, are two small bevel pinion clutch gears which are constantly in mesh with a large bevel gear. This bevel gear is mounted on a shaft which drives the slide through a pinion gear, vertical shaft and rack. These pinion gears run free on the shaft until a double-faced clutch, slidably keyed on the shaft, engages the clutch teeth on the inner face of either pinion gear according to the direction the slide is to travel. The clutch is shifted by a lever which is actuated by adjustable dogs on the wheel slide rack. To the lever are attached two legs connected by a tension spring of sufficient strength to shift the clutch into mesh with either pinion gear instantaneously.

The slide for the raising and lowering of the work-table runs in broad bearings, and is raised or lowered by a hand wheel bearing on indicator disc, graduated to half-thousandths of an inch. A tapered adjusting gib runs the full length of the slide and it can be raised or lowered by turning a screw at the top, thus changing the adjustment equally at all points of the slide.

The chuck or work-table spindle has a hardened steel collar with a tapered face shrunk on it at the upper end.

The spindle is driven by a large bronze worm gear mounted on the end of a universal shaft. This gear is constantly in mesh with a large cast iron gear running free on the spindle and which can be locked and made to rotate the spindle by means of a friction clutch. The entire chuck spindle bracket is pivoted on a taper pin so that it can be titled forward or back for grinding bevelled or dished surfaces. The bracket is adjusted by means of a screw showing just above the plate which indicates the angle of adjustment.

The magnetic chucks used are radically different from most types. The chuck proper is composed of but three castings, the body, core and bottom plate. These parts are all made of the very best grade of electric furnace steel obtainable and have a permeability equal to that of the best Swedish and Lancashire iron, which means that they will carry a maximum of magnetic lines of force per square inch.

The chuck face is so designed as to give the greatest amount of magnetic edge, which necessarily ensures tremendous holding power all over the face and pieces as small as ½" in diameter can be held at any place on the face. A single, high power, circular coil is used, and the current is specially calculated so as to produce no excessive heating.

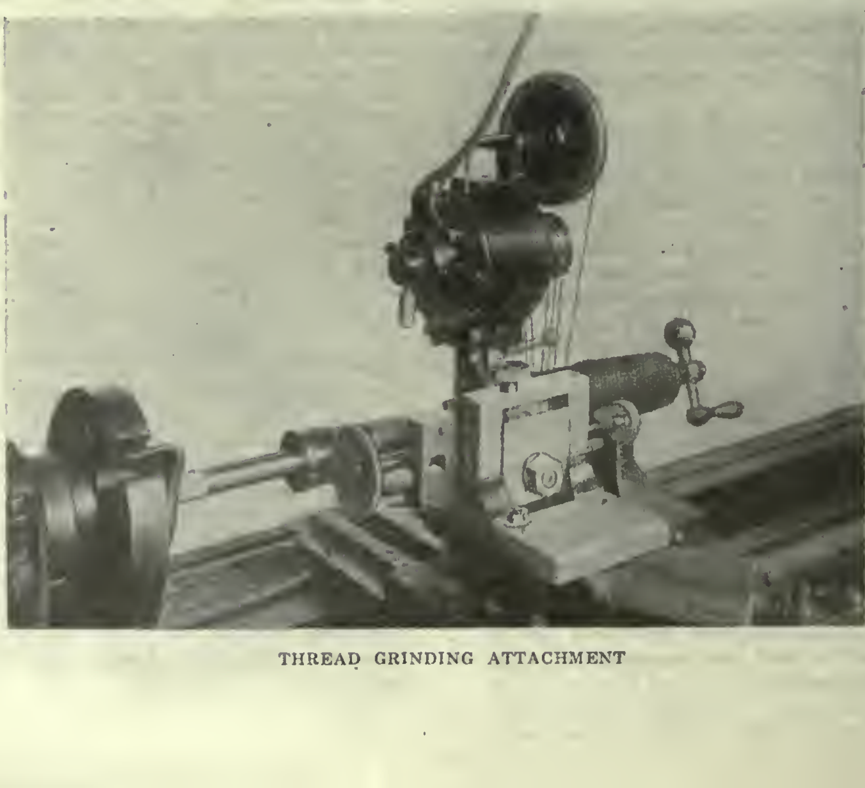
A demagnetizing switch is supplied so that work can be removed from the chuck by simply throwing back the switch, which reverses the current for an instant and so demagnetizes the chuck.

THREAD GRINDING ATTACHMENT FOR LATHE USE

The excessive demand for master thread gauges for the rapid and accurate manufacture of munitions has clearly proven the uncertainty and the impracticability of the lapping method of their manufacture. It has furthermore demonstrated the desirability of a more rapid method of manufacture. The International thread grinder, made by the International Equipment Co., is the result of three years' experimenting in connection with thread gauge work and promises to be of high value in the manufacturing industries of peace as well as of war. It will do practically all that a large and expensive cylindrical grinder will do and other operations beyond their scope are easily possible.

The grinder may be attached to a lathe compound rest as easily as any other tool. It has an individual motor drive through a continuous round belt which permits of the greatest flexibility. Vibration from the lathe cannot be transmitted to the wheel. The spindle is mounted on Norma dust-proof ballings.

The wheel can be run up to 7,000 revs. per min. and is trued with a diamond which can be set accurately and quickly to any desired angle. This device insures the exact shaping of the wheel to the form of whatever thread is to be ground. It is easily portable, weighing only 50 pounds. and occupies very little space. Standard cylindrical gauges, both plug and template, are ground to size after hardening without the necessity of lapping. Reamers may be ground, taper and straight and may be backed off.



THREAD GRINDING ATTACHMENT

THE EXPERIENCE OF NINE YEARS BUILDING TRACTORS IN CANADA

The Mistake Was Made in the Early History of the Enterprise of Turning Out a Machine Too Heavy For Practical Use on the Land

By JOHN MUIR, President Goold, Shapley & Muir Co., Ltd., Brantford

"OUR Company have been manufacturing tractors for nine years. We started with 28 HP. machine, belt power; weight 12,000 lbs.; this engine would pull three to four 14" plows.

"At a trial held under the Winnipeg Industrial Exhibition about this time, the American manufacturer had larger and heavier engines of sufficient power and weight to pull six and seven 14" plows. The Western farmer paid but little attention to what was then termed by them our little tractor, and followed the larger machine. This condition inspired our Western branch houses with the idea that there should be engines of larger capacity, and they prevailed upon us to produce a larger engine. At the next trial, a year following, at the same exhibition, our company exhibited a 35 HP. engine, belt power; weight 14,000 lbs., which had the power to pull five 14" plows, but the American manufacturers had again produced larger than their former engines and exhibited engines that would pull ten and twelve plows, and we were then prevailed upon to build a still larger engine, and the third year at the Winnipeg Exhibition, we exhibited a 50 HP. engine which weighed 17,000 lbs.; some other makes of the same power weighed 23,000 lbs.

"This condition has by actual experience in the traction engine business, namely the production of heavy engines of larger power, been a most unfortunate chapter in the development of the tractor business to the Western farmer, and many of these farmers were placed in a very awkward position financially through having to pay for these heavy engines which were unsuited to the work which they had to do with them, and while this is true, the loss was also very heavy to the manufacturers, who were compelled to take their engines back in many cases and they were largely scrap, and very often handed back the money or notes to the farmers who had purchased, rather than injure their reputation.

"The Hon. Mr. Motherwell, Minister of Agriculture for Saskatchewan, wrote letters in the Agricultural papers in Western Canada, condemning these heavy tractors, and warning farmers against using them, and this seems to have been the end of the heavier traction engines for agricultural purposes. Following this, there has been a race as to who could produce the smallest and lightest tractor. I have a report in an American paper, namely, 'Farm Machinery, Farm Power,' published in St. Louis, Mo., before me, giving the names of six men killed and four injured for life, by one of the lightest made tractors toppling over backwards on the operators and crushing their life out. This is an engine of an American make.

"In reference to present day and future tractor business, there is undoubtedly a good business to be done in this country and, in my judgment, it will continue to grow, if the proper tractor, namely, a tractor of the right size and weight, is placed in the farmers' hands. What is needed is one that is adapted to do the work required of it, both in the field and by operating from the belt, and there are thousands which will be required.

"Conditions, however, for the use of a tractor, should be considered by the farmer before he purchases. On rough, stony farms the farmer would be well advised to use horses and not tractors for the tilling of his soil.

"From my observation, my judgment is that two sizes of traction engines are required to meet the different conditions and work where conditions vary as to the requirements. The ordinary farmer should have power enough in the engine he purchases to fill his silo in a hurry, run a medium-sized thresher, grind his grain, and take care of all power requirements on the farm, and also to pull three or four plows, according to the condition of his soil, and if desired to draw the other implements to till the soil and take off his harvest. There may also be a limited place for a smaller tractor in some cases. I have given you, shortly, my views and the experience of our company in the tractor business to date, and I trust it may be of interest to your readers."

Trade Gossip

Alteration to Plant.—The Chatham Packing Co. has applied for a permit to remodel their plant on Whitehall street at a cost of $12,000.

Province to Build Hospitals.—The Public Works Department of the Province of Alberta are planning the erection of hospitals at a number of small towns through the province.

Engineering Contracts in Toronto.—The Roman Catholic School Commissioners will call for tenders in connection with the heating, ventilation and plumbing for the new St. Patrick's school now being erected.

To Locate in Vancouver.—It is stated that the Sydney Rubber Co., Sydney, B.C., will erect a manufacturing plant in Vancouver in the near future. The manager is Mr. B. D. White, 402 Pender street west.

Regina Wants New Branch Lines.—A resolution was passed recently at the meeting of the Regina Board of Trade asking the Dominion Government to construct a branch line connecting Regina with Avonlea on the Canadian Northern Railway.

Large Building Programme. — The Government of Alberta are considering extensive building plans for 1919 and 1920. These include a new government building on the capital grounds. The provincial architect has received instructions to prepare sketch plans for the first unit of a large number of departmental buildings, which will eventually be constructed on the ground to the south of the capital building. The Department of Agriculture will ask for an appropriation for a number of buildings to be erected during the coming year. It is proposed to build a dormitory at each of the farhing schools in Vermilion, Olds and Claresholm, to cost about $150,000 each.

Unfilled Steel Orders.—The United Steel Co. of Canada had on hand at November 30 unfilled orders to the amount of 8,124,663 tons according to the corporation's monthly statement. This is a decrease of 228,630 tons, compared with the orders on October 31.

War Trade Board Announcement.—"In view of recent developments which have made the steel situation somewhat easier, and especially in view of the fact that certain United States restrictions have been lifted and others modified, permitting shipments of plates, boiler tubes, etc., being made to Canada more easily than in the past, in future it will be unnecessary to apply to the War Trade Board for releases from stocks on forms which were provided for this purpose, neither will it be necessary to supply monthly reports, as in the past. Dealers and others are now at liberty to dispose of their stocks wherever they can, but the War Trade Board reserves the right to fix the price of the same in the event receiving complaints to the effect that prices which are being charged are excessive."

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CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly journal devoted to the machinery and manufacturing interests.

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Looking For Trouble

THERE are a number of people in Canada at the present time who are going to be greatly disappointed if this country is not going to have its fair share and a little more of dull times.

Of course, they are not going to get up openly and state that this is their avowed policy, but they are doing it in another way, one which is quite as effective as though they climbed on the house-tops and shouted from the roofs.

The first thing they start when meeting a friend in casual conversation is something to the effect that we are in for some dull months—a lot of people out of work—the manufacturers not going ahead with any new lines—thousands of soldiers coming back with nothing to do—you know the run of their talk. It's generally done in a whisper, in a doorway, not very often out in the open, where some red-blooded citizen could get hold of the thing and put it out of misery.

The Ottawa representative of *Financial Post* puts the case well this week when he says:

> "All over Canada the suggestion of coming trade depression seems to have gained considerable currency. Men are, commonly, pessimists, and like to prepare themselves for the worst when there is no particular reason why the worst should happen. If they confined this feeling to themselves the trouble would be, as the doctors say, 'localized'; but your true pessimist delights to go about infecting his neighbor with the germ. 'The awful slump after the war' is an expression which has got into the mouths of too many people who are otherwise sensible. Such people show just about as much good judgment as the proprietor of Amerongen Castle who invited that other awful infliction, the ex-Kaiser, to come and visit him."

One might almost surmise that some of these blue-ruin shouters would have wished that the war and the killing at the front could have continued indefinitely in order that business might remain extra good for their particular line. The fact that the casualty list of our men has ceased to haunt us daily weighs with them not at all.

If these whisperers of dull times would only expend half the energy in preaching hope, optimism and courage as they are in aiding a cold feet campaign, they would indeed do a service well worthy of the name.

A Commercialized Christmas

THE mad campaign of forced selling, the constant striving to create an unnatural feeling of excitement, are doing much to make the Christmas season a nightmare instead of a blessing, a time to be dreaded rather than joyfully anticipated.

The big stores have grabbed Christmas. They have annexed Santa Claus, and they have turned the whole outfit into a dizzy whirligig, not to spread or create joy, but simply to separate the people from more money than they would spend were they left to their own common sense and the limitations of their purse.

The real spirit of Christmas has been backed so far into the ditch by the gorgeous procession of a commercialized season of festivity that it hasn't got one chance in ten to get a hearing.

There is calm deliberation that spoils anything approaching spontaneous giving.

In too many cases we give in 1918 because we received from the same source in 1917. It is a mild form of bargaining, and it grows and increases until many a person finds himself approaching Christmas with a feeling closely akin to a mild form of financial hysteria.

The simple little gift, prompted by affection, given with no thought or expectation of a return present, is the nearest approach to the real Christmas feeling. It is getting squeezed so hard by the commercialized Christmas that the chances seem to be that it will pass out and give up the struggle.

What the world needs and longs for is a sane, sensible, real Christmas—one that reflects the meaning of the season, and refuses to become partner to the annual scramble to fling money into the coffers of merchants who must unload their truck or cut the price.

The Hat With Ear-Tabs On

WHEN the wind turns to the north, me boy, and blows to beat the band, as though it was a-comin' from some icy, snow-bound land; when it sifts in past the cellar door and through the keyhole, too, and makes the knuckles on yer fists turn sixteen shades of blue—when the cistern pipes get all friz up and the bloomin' thing won't spout, until you get the kettle and begin to thaw her out.

Oh, it's then we feel our ears get cold as they flop out in the breeze, and sway before each bitin' blast like some old poplar trees—our old felt hats and hard ones, too, they cover up our dome, but they leave our ears a-stickin' out to face the frost and foam.

And yet you see folks goin' around wrapped up in furs and rugs, but not a thing about 'em for to bolster up their lugs—they hold their fists up to their ears, they wheeze, they blow and cough as though they was a-goin' to shake their thinkin' tank right off.

I ain't got sympathy for them what prowls around like that, determined in the zero days, to wear a summer hat.

Ah, let 'em go to some old trunk where boyhood stuff is stored, and where the olden garments live for times when winter roared, and let 'em cast away their pride, they know right well. I swan, they'll get again that fuzzy cap that had the ear-tabs on.—ARK.

Canadian newspaper publishers pay about $3,500,000 a year for their white paper.

Some of the largest Canadian and American newspapers consume from 50 to 100 tons of paper daily.

The daily consumption of newsprint paper in Canada is, approximately, 250 tons; in the United States, 5,750 tons.

Canada's daily output of paper, made into a continuous strip three feet wide, would be long enough to girdle the globe at the equator.

There's Big Business Ahead of Canada

CANADA is glad that the war is over.

War business was good. But back of it all there was a feeling in the heart of every man worthy of the name that there was something undesirable about the business. It meant employment—it meant dollars—it meant big money—it also meant death, mutilation, suffering and heartbreaks.

Industrial Canada longed for the day when the word "war-trade" should be removed. It meant less business, some disorganization, some loss. But away and above that it meant the removal of that nightmare that had haunted Canadian firesides for endless months—the casualty list.

So when you are minded to mourn the loss of war orders, put the two things in the scales, stand back and look at them. There they tilt, dollars on one end of the beam, lots of them—on the other our own men and boys, our sons, brothers, fathers and friends. It doesn't take long to decide, does it? We gladly reach out the hand, and, brushing the dollars aside, welcome back the civilian soldiers to our midst.

Canada's war achievement in the turning out of shells, fuses, airplanes, ships, and all manner of munitions and supplies, has been remarkable.

When Canada turned to shells the impression seemed to be that a few tinkers had gone crazy.

The number of people who accepted it as a fact that Canada could solve the problem, reach capacity production and keep the product to the high standard necessary, were few and scattered.

The pioneers soon proved that it could be done. The circle of shell plants widened, and it became an accepted fact that the Canadian shell shop was a great, big, strong link in the Allied chain that was going to put an end to Kaiserism.

And now for the future?

Don't make the serious error of thinking that recovery is the work of a day or a month.

Along with the rest of the world, Canada has been war-sick. The doctors in charge, Foch, Haig, etc., have announced that the patient is going to recover. Canada is recovering, and her tremendous resources, her financial position, her broad acres, her powers of construction, and the initiative and determination of her own people will work wonders.

There is, perhaps, a tendency to hold back in some cases, to see what is going to happen, to watch what the other fellow intends to develop. When you find a lot of men holding back it's an easy matter for one courageous chap to step out and take a lead that it's mighty hard to take away from him afterward.

If you've made money during the war period, remember that it was from an abnormal cause. Remember that your money was made while others were getting shot and shot at. Remember that there is a responsibility on your shoulders that you dare not discount, and a burden for your back that you dare not shift.

There is big business on ahead. And it is for him who prepares for it. This preparation calls for study, for investment, for patience. You owe it to the man who shouldered a gun and went away to fight your battles to see to it that he has a decent place to live in when he comes back. Don't let him return to the place that urged or forced his enlistment, and cheered his departure, only to find that it's a barren and a jobless land.

Be as liberal and brave with your dollars as you expected him to be with his life and limb.

Canada is a great country—a wonderful place. It needs sane and careful development. It needs to be turned into a good place for the man who wants to do an honest day's work and into a mighty poor place for the man who wants to loaf or camp on the necks of his fellows.

There's a big gap between the farming interests and those of the manufacturers. There are men abroad, who for purposes of political expediency, are making it their business to dig trenches and build barriers between these two great interests. They do not want the farmers to understand or appreciate the problem of the manufacturer, nor do they desire the manufacturer to be in a position to become familiar with the business side of farming.

The longer the farmers and manufacturers fight each other, the better pleased will be the political pirate.

There is room in Canada for farmers and manufacturers. They are both here now and they are going to be here in large numbers in years to come. Their best interests are going to be served by a mutual understanding and a cessation of small squabbling for political purposes.

Canada is going ahead. Canada is not going to the bow-wows. Make that your starting point. If you've got any doubt on your mental slate, reach over and dip your rag into the big pond of optimism and get that slate right.

Get your eye on the big business of the future. It's there just as sure as Tuesday follows close on the heels of Monday. But it's for the man who is brave enough to go out and get it. There's not much brought in these days to the doorstep of the man who shivers at problems that to bigger men look like golden opportunities.

Current Events in Photograph

PREMIER TROOPSHIP ARRIVES AT HALIFAX

THE photo shows the giant White Star liner Olympic on her arrival at Halifax last Saturday with nearly 6,000 Canadian soldiers on board. The trip marked the completion of her 19th voyage from British ports to Halifax, and she brought the largest number of returning soldiers that has yet been carried to any Atlantic port. The Olympic, which is the queen of the White Star fleet, was given a rousing welcome. For nearly three years this grey leviathan has come and gone without ever a line about her movements being printed. Week after week, under the skilful command of Captain Hayes, R.N.R., D.S.O., she ran the gauntlet of the German "U" boats with her precious cargoes of fighting men. Of the 70,000 Canadian soldiers she carried from Canada to the Motherland, not one was lost at sea. Note the manner in which the big liner is camouflaged.

THE record made by Canadian shops in the production of munitions can hardly be appreciated by the people of Canada. In years past we have been in the habit of taking it for granted that our industrial efforts would be of secondary importance. We have hardly dared come to the conclusion that as a producing people in an unknown line we could lead the procession.

When it was first proposed that Canada should undertake the production of munitions the manufacturers were inclined to be skeptical. It was something new—the war might end at any time—a lot of new and special purpose machinery was required. In fact it was some time before the more energetic manufacturers had come to the stage where they found that they could make munitions, and make them successfully.

In fact, Canada's effort in munitions was in keeping with the record made at the front by her sons. The number of decorations won on the field of battle tells the story. The figures are complete only up to July 1st, 1918, and the totals would be increased considerably.

Victoria Cross	30
Distinguished Service Order	432
Bar to Distinguished Service Order	18
Military Cross	1,467
Bar to Military Cross	61
Distinguished Conduct Medal	939
Military Medal	6,549
1st Bar to Military Medal	227
2nd Bar to Military Medal	6
Meritorious Service Medal	119
Mentioned in Despatches	2,573
Royal Red Cross	130

NORWEGIAN CONTROL OF THE MOLYBDENUM MARKET

The growing importance of molybdenum in the manufacture of steel is giving Norway an influential position with regard to that industry. Numerous discoveries of molybdenum ores have recently been made in that country, and its Government has taken steps to secure to native industry the advantage of this discovery.

CANADA'S LEADING MACHINERY HOUSE

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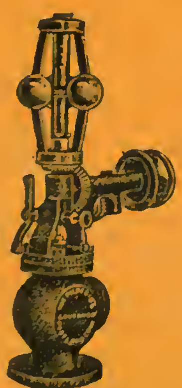

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Includes Speeder and Sawyer's Lever.

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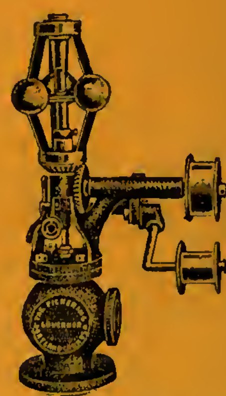
This Governor is very popular throughout the Dominion, brought about by constant efficiency, reliability and durability.



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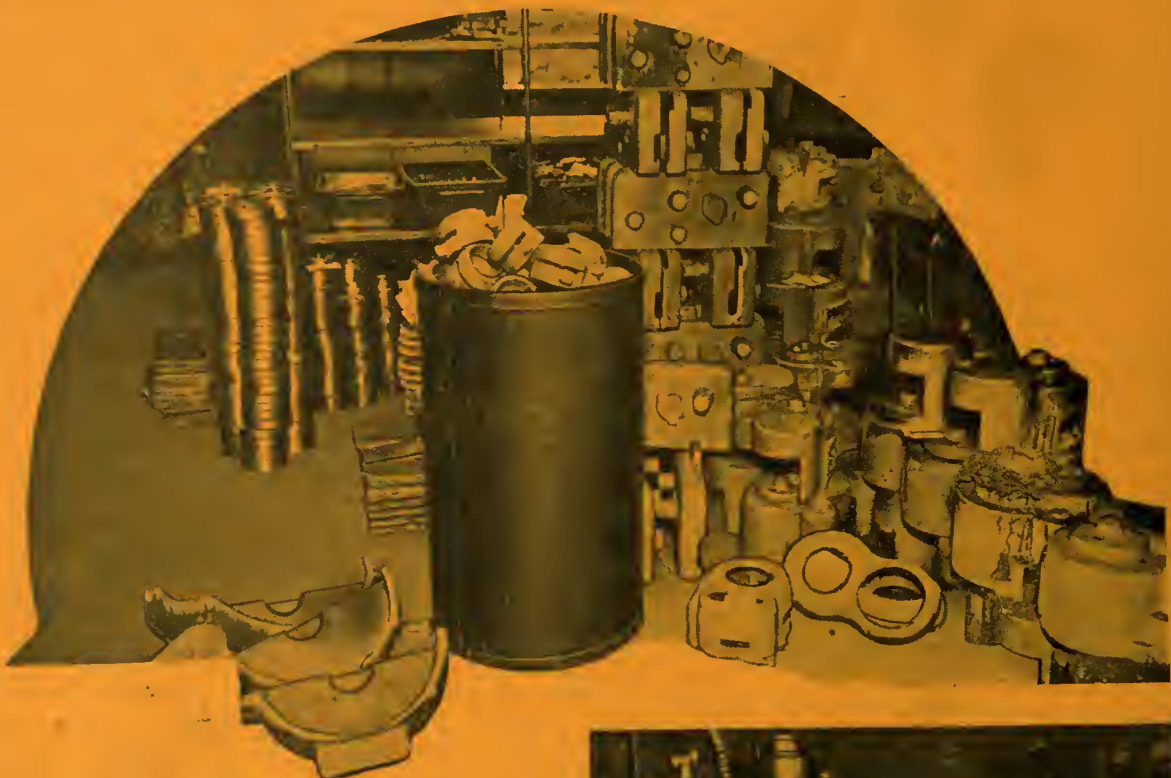

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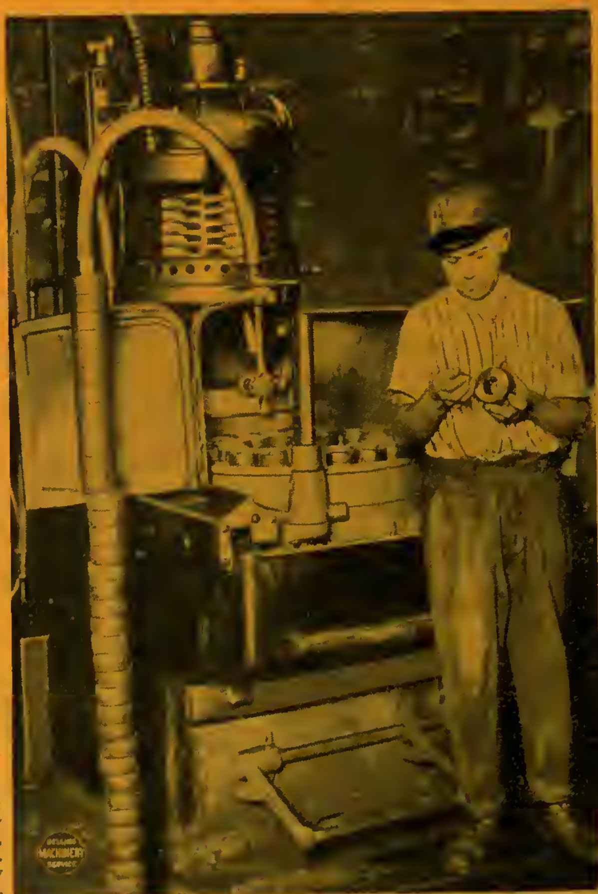
Excellent Results at the Hendey Plant



This collection of parts is finished on two Blanchard Grinders, the first installed 6 years ago, the second one three years later, in the Hendey Machine Company's plant, at Torrington, Conn., and is an excellent example of the economy of "Blanchardizing." There are lathe aprons—ground on two surfaces and subjected to an unusually rigid inspection test—gear housings, outside gear boxes, vise jaws, gear box covers, collars and a dozen other parts, besides blanks for all of the twenty-one gears used in the Hendey Lathe—ranging in size from 1¾ to 9 inches diameter and ground to limits plus or minus 0.0005". Versatility is not the only feature to recommend "Blanchardizing," but it is important. Speed and accuracy are additional advantages. Let us tell you more about these machines.

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Complete description in Bulletin.

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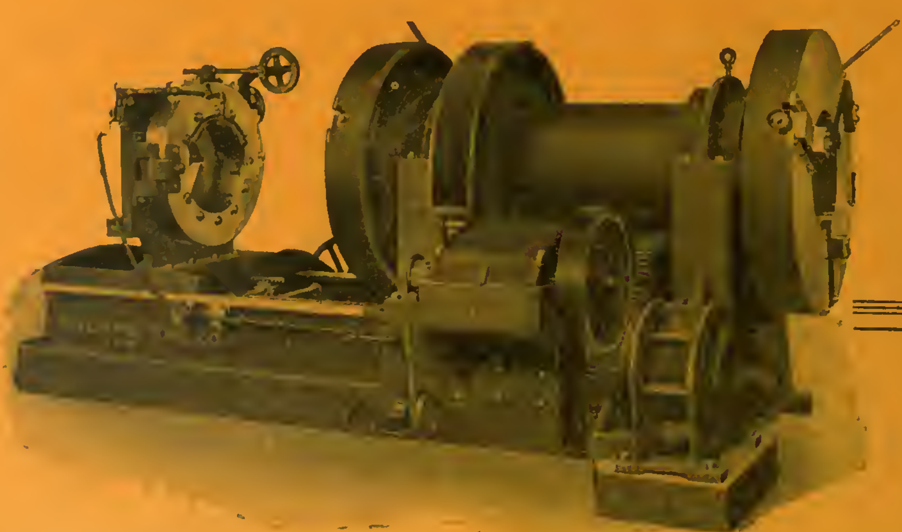
TRAVERSING BASE SCREW JACKS



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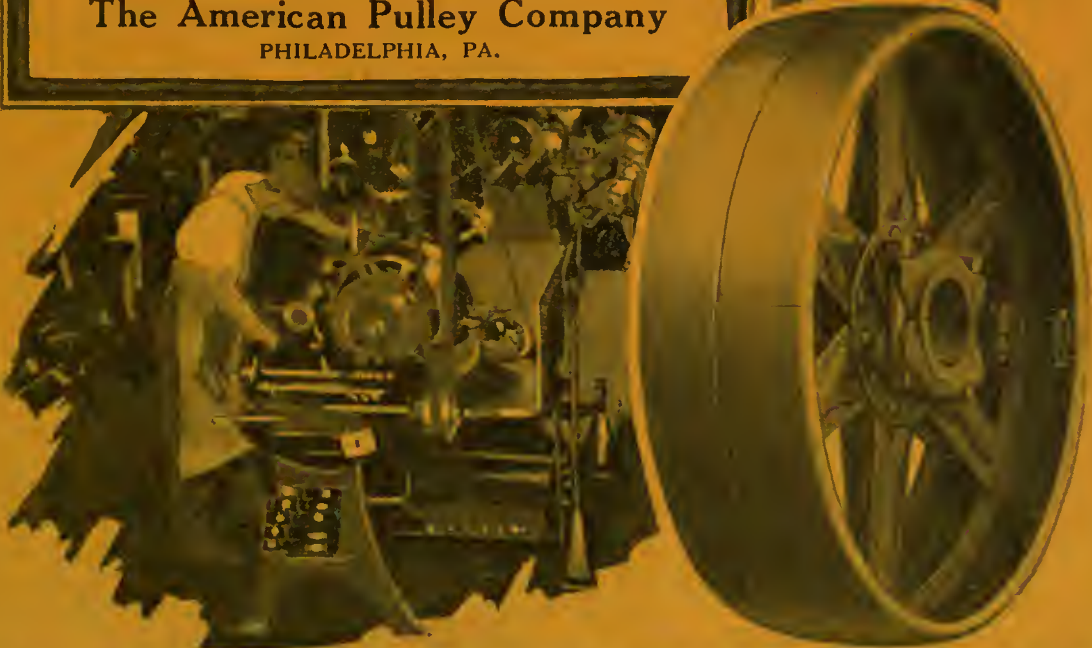

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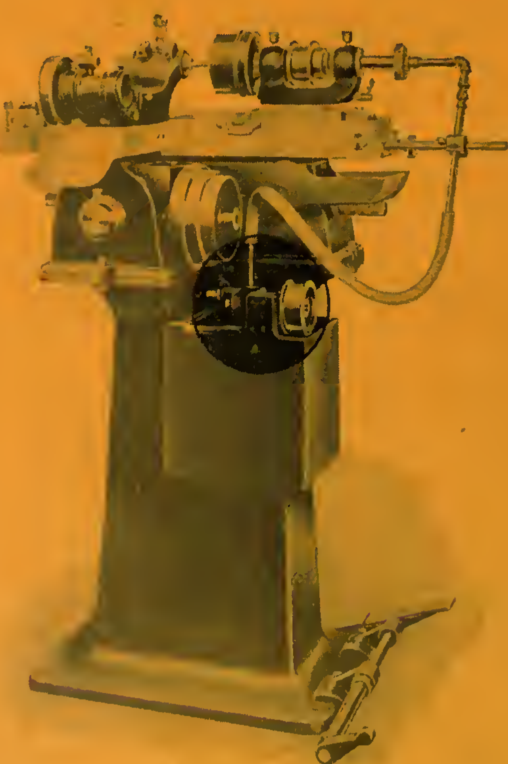

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MARKET DEVELOPMENTS

Signing of Armistice Changed Many Prices

Markets in Some Cases Have Had a Wild and Merry Career During 1918—Machine Tool Dealers Moving Very Carefully With Regard to Taking on Used Shell Shop Stuff

ONE of the most outstanding events of the year has been the very high price at which ingot tin sold. The quotations referred to here are New York figures, and to them should be added duty, freight and exchange. At the first of the year tin was quoted at 80c lb., while on January 10 the price had gone to 85c. From January 16 to the end of February there were practically no quotations at all as no tin was available. On May 2 tin had reached $1, and by May 13 it had touched $1.05. The price remained practically at that until the end of October. Last quotations were at 70c. The high value at which tin traded doubtless made fortunes for some of the speculators. In fact it was a highly fictitious price all through, and did not represent the intrinsic value of the metal. There was a great falling off in consumption by the usual users of tin as the governments in several countries made it impossible for makers of tin cans, etc., to enter the ingot market for their supplies. In the usual course of events this country anticipates a certain amount of tin from Dutch West Indies, but the Dutch Government secured control of it and prevented export. Supplies from Malay Straits and the Grecian Archipelago did not arrive. The situation was controlled almost directly by the British Government. Munitions used very small quantities of tin, and although the price was very high the demand for it was not as keen as though the extra work being done called for larger proportions of tin.

Copper has had a rather uneventful year, although there has been a very great deal of it produced and used, the demand being largely augmented by the calls of munitions plants. The January price was 23½c, which was raised by the War Board of United States in July to 26c, at which price it will remain until the end of the year. Casting copper was uncontrolled, and the strange part of the situation is that this sold at a higher figure than lake and electrolytic, an event not experienced before as it is an inferior article.

There were no outstanding surprises during the year in spelter or lead. Spelter was fairly strong around the opening of the year, but declined, at present being quoted at 7¾c. There was a fairly active trade in lead.

The Scrap Metals

The scrap metal market has followed a peculiar course during the year, but one very closely connected with the trend of war trade. At the outset it should be remembered that copper constituted the great bulk of the trade as far as the open market was concerned, as the steel turnings from shell shops were directed and controlled by the Imperial Munitions Board. The trade has been under fairly close supervision from the War Trade Board at Ottawa for some time past, and it has been necessary to report the amount of material in yards, the amount received, and the amount sold. The export of scrap to the States has been under embargo with the exception of copper and a number of grades of brass. The market has been dearer here than in the United States, and for that reason there was not much advantage in looking to the U. S. market as an outlet for Canadian scrap.

The labor situation has not helped matters much. In the months when the yards were pressed for help it was almost impossible to secure the required hands for sorting material. There is a marked change now, and an unfortunate one. Men are looking for work and the yards are in a state of complete inaction.

Dealers are not in the market now. That statement can be accepted as quite truly representing the real state of affairs. The bottom has dropped out of the market, and there does not seem to be any immediate prospect of any person being able to put it back in. Sellers having offerings that look good are being advised if they can do so to hold on to them until the market begins to take on a more definite form. Even where quotations have lowered on shipments no improvement is noticed. Figures that are given as representing the value of offerings are no true indication of the real state of affairs. For the purposes of actual trading just now one might just as well begin on the assumption that there is no price list at all.

The Selling of Steel

There are two outstanding features in the steel market for the last year or so. One is the very high price to which some of the lines moved, and the other was the way in which the steel interests stood behind the Government when their industries were brought under control. It is a matter of record that steel plate was sold in Canada as high as 17c per pound during the war period, and a high mark of 12 cents has been established in some cases this year. The matter of price regulation was taken up at Ottawa, following the formation of the War Trade Board, and from this was worked out the rather intricate and sometimes confusing system of licenses, priorities and permits, etc. There was very little effort to put anything over the Government on the part of the mills or dealers. There was a good display of practical co-operation and this feeling was of tremendous benefit to the government.

One of the first lines to feel the price control regulations was that of ship plate. The Government decided that they would recognize a maximum price of 10c from the warehouses and 7½c at the mill where the material was rolled. As soon as the armistice was signed this price began to slip and to-day's quotation is 7c from the warehouse.

It has been a hard matter for the trade to keep in stock anything approaching a complete assortment of boiler tubes. The mills were not allowed to take skelp for the making of tubes, and on that account there was a shortage that interfered even with the most necessary repairs.

Toward the end of the year there has been a pronounced shortage in sheets, with prices at high levels. In common with other lines this situation is being relieved and the price is subsiding.

Machine Tool Selling

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connection with the trade of the year, and with the trade of the entire war period for that matter, is the fact that nearly the same machine tool dealers are in business now that were when the war began. There has been a very large volume of business handled. There have been plant lay-outs made that are a credit to the skill of Canadian mechanics and salesmen. There has been a searching from coast to coast for machine shop capacity to turn out machinery for the production of shells. The work of keeping all these sub-contracts in line and also keeping them working at the same pace was indeed a problem to puzzle the most experienced.

There is a large amount of machinery offering now from the shell shops. A good many sales would be made were the dealers willing to take in the shell shop stuff on the basis of part payment on new material. It is not likely that this will be done to any great extent, although there are times where a machine is good and has been well used or perhaps used very little at all. The straight single-purpose machine will be scrap and there is no help for it. Other machines that were adaptations from standard machines with shell equipment may be altered and changed for their original work. Then there is a great deal of general-purpose machinery that is capable of being turned to many other lines. Some fairly large-sized deals have already gone through whereby dealers have taken over parts of this material. When a dealer finds a plant that has used machinery that has been well cared for, or that has not been in operation for a great length of time, he has a chance to store and hold this for future sale. Other firms are refusing to consider used machinery at all, either on the basis of a deal or a sale.

MONTREAL REPORTS THAT SALES ARE MADE IN USED MACHINERY

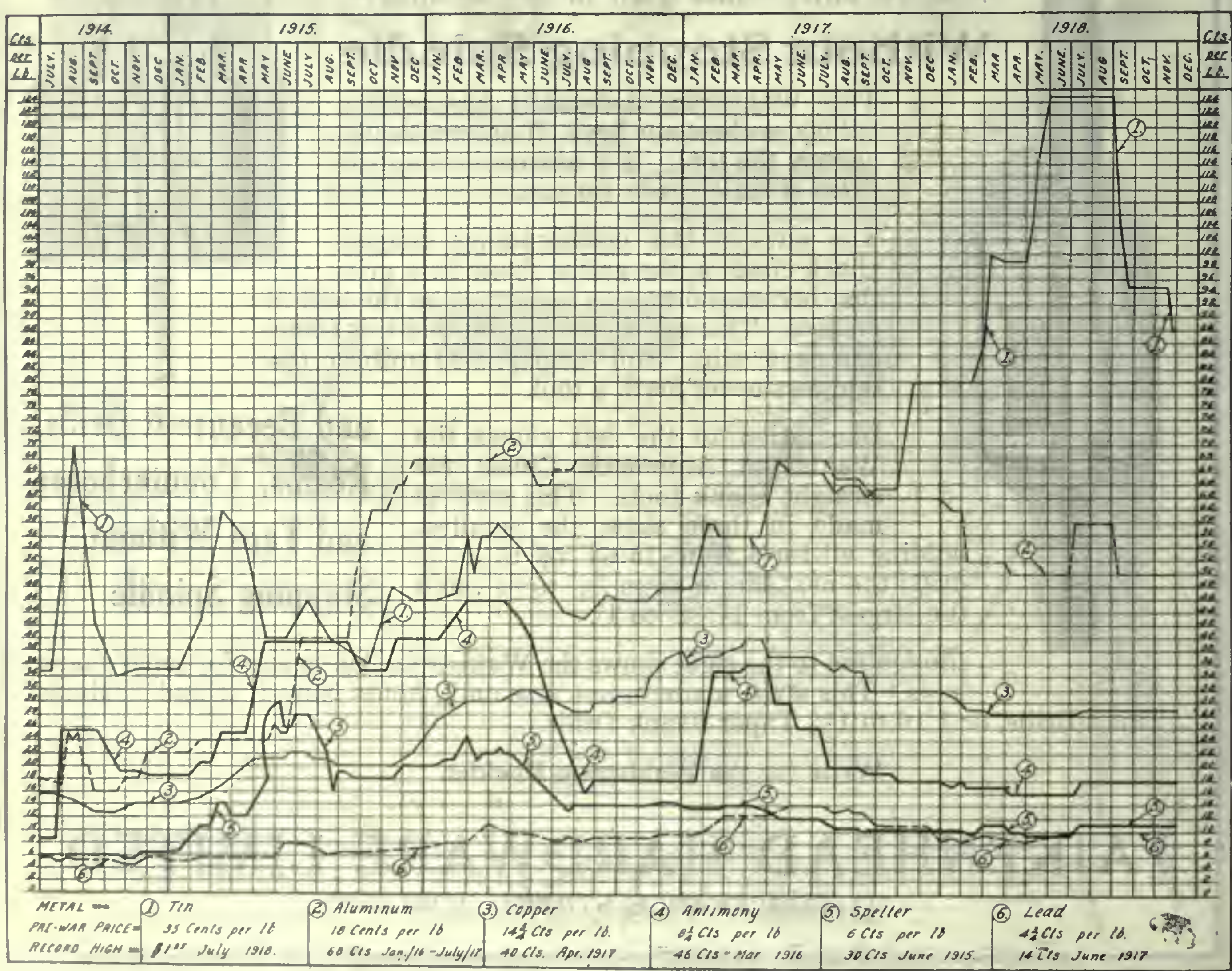
Special to CANADIAN MACHINERY

MONTREAL, December 26, 1918.—Despite the falling off in industrial enterprise as a result of cessation of war activities, business is proceeding as usual, but in less volume than formerly. Readjustment is occupying the attention of many plants recently engaged in war work, and the period of settlement in this connection is expected to extend well into the new year. A feature of present activities is the work of machine tool dealers in the purchase and disposal of the equipment used in the manufacture of munitions, not so much in special purpose tools, but in such standard machines as are available. During the past few weeks much of this class of machinery has changed hands. The metal situation has taken on an easier tone, and with the exception of lead all metals are lower.

Steel Becoming Easier

There is every indication that the New Year will open with lower quotations on many lines of steel and iron commodities. While nothing definite has been announced here it has been intimated that Canadian prices will follow in the path of those set in the American mar-

Table Showing Price Fluctuations of Non-Ferrous Metals



kets. The steady easing up in the plate situation has apparently opened the way for a general return to more normal price levels in other lines. While the present volume of business has shown a marked falling off, material is obtainable with considerable less difficulty. Holiday traffic has not affected shipments a great deal and delays from this cause have been relatively few.

Weakness in Metals

Copper demand is steady but light. With the possibility of a lower price or an open market it has made the situation easier and prices this week are 2c lower than last, lake and electro are quoted at 29c and castings at 26½c per pound. Tin is coming through in good quantities and prices here are gradually assuming more reasonable figures; the present price of 80c is a decline of 3c per pound. Spelter is weak and easier at 9½c. Lead is firm but antimony has declined 1c to 11c per pound. A weaker demand for aluminum has lowered the quotation to 43c per pound, a drop of 3c on the week.

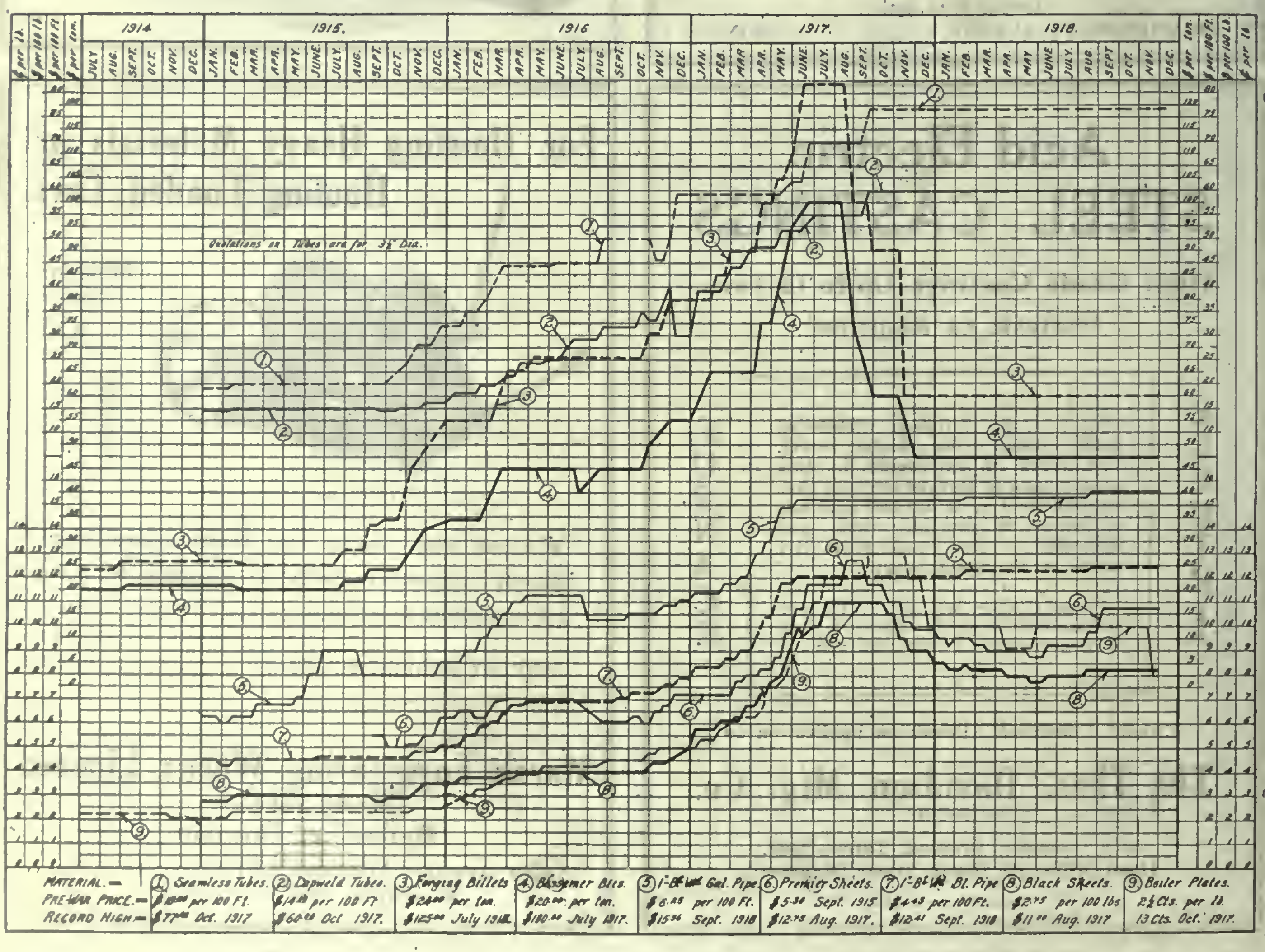
Used Equipment Moving

The volume of business passing through the hands of tool dealers at the present time is not large when compared with that of a few months back, but under existing conditions the demand for tools, especially those that have seen some service, continues to be quite encouraging. Enquiry for new machines is light, but the sales of second-hand equipment is larger than one would think in view of present circumstances. A feature of recent sales has been the disposal of tools to parties that have had shell-making experience and are acquiring a few machines for starting up a small repair shop in some outlying district. Quite a number of sales of this description have been reported, many of them here for small places in the province. One large dealer here reported that the total of cancellations since the war was about $50,000, the bulk of this being in ordered equipment under manufacture. The same dealer has at present on the shelves approximately $5,000 worth of small tools that are virtually useless other than for shell work. In many instances these tools are secured at little better than scrap prices, and the purchasers are able to obtain the tools at a reasonable figure. Quotations on new tools are well maintained, and it is not likely that the decline will be marked for some little time owing to the material and labor costs.

Scrap Market Still Waiting

Nothing has developed during the week to alter the dull trend of the old material situation. The season is one that in ordinary times is marked by inactivity and this year is additionally emphasized by the unsettled conditions incidental to the stoppage of all industrial work in connection with the manufacture of munitions and other supplies. It is, however, anticipated that early in the new year general business will take on more interest, the trade at present apparently awaiting a further softening in prices. While to all appearances the market in common with others is free from control, there is as yet little to indicate that the situation appeals to general trading. One large dealer here has orders on his books for considerable scrap for early 1919 delivery, but buying for this has been deferred until a later date. Changes in price quotations are looked for in many lines very shortly, but present prices are firm but of a nominal character. A decline of $2 per ton is noted in wrought iron axles and car wheels, the quotations being $30 and $36 respectively.

Table Showing Prices for 1918 in Iron, Steel, Tubes, Etc.



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WHEN, in a little shop down on the river front, seven years before the Civil War, this organization was established as CURTIS & CO. MFG. COMPANY, no one could have prophesied that it would continue to exist and grow and outweather three great wars—yet, today the CURTIS plant of nearly 20 acres and over 2,000 employees, and with a national reputation, is a graphic reflection of the CURTIS policy.

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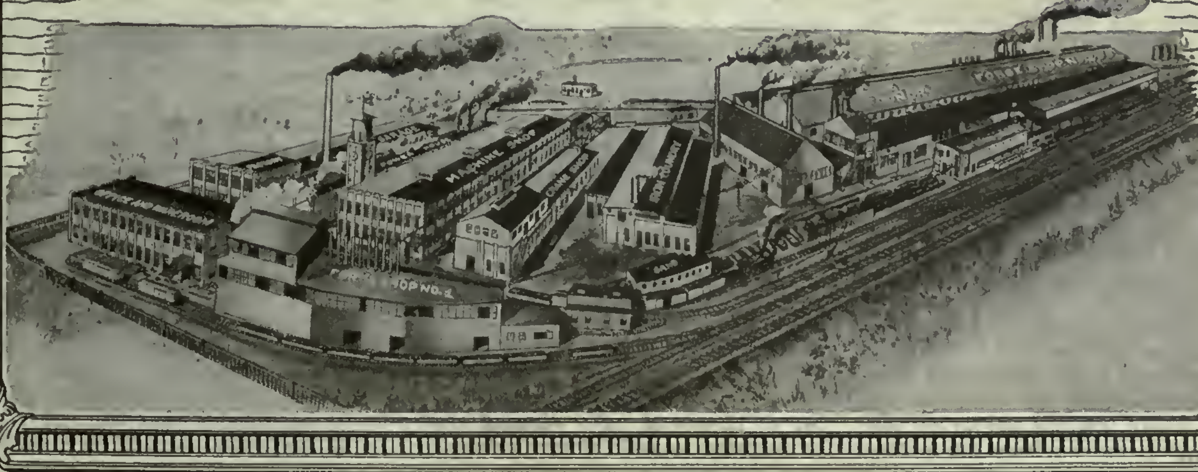

Scotia's Output of Coal Decreased During 1918

Labor Troubles Have Made Production on Large Scale Impossible —New Undertakings on the Part of Dominion Steel Corporation —Surplus Labor Being Absorbed in Lumbering Industries of the Province

By F. W. GRAY, Member Institute M. E.

THE coal production of Nova Scotia during the war period, including the year 1918, compares with the maximum production of 1913 as follows:

	Long Tons
1913	7,268,485
1914	6,650,031
1915	6,709,951
1916	6,171,424
1917	5,667,000 (about)
1918	5,175,000 (about)

The production of the larger companies compares with last year and with 1913 as follows:

	1913	1917	1918
Dominion Coal Company	5,120,573	3,916,548	3,640,000
Nova Scotia Steel Co.	813,877	577,171	489,000
Acadia Coal Company	539,121	398,507	280,000
Intercolonial Coal Co.	189,550	179,700	175,000
Inverness Coal & Ry. Co.	293,847	202,719	200,000
Maritime Coal & Ry. Co.	155,051	200,000	180,000
Other Operators	151,466	1 92,355	211,000
Total	7,263,485	5,667,000	5,175,000
Percentage of production from Cape Breton Island	81½%	78%	78%
Reduction from the basis of 1913...	......	23%	30%

The coal consumed in steel manufacture and allied processes was in 1918 approximately 34 per cent. of the total production, comparing with about 22 per cent. in 1913. The amount of coal used at the colliery fires, on the local colliery railways, and in domestic consumption by the workmen, would, in normal times, represent about ten per cent. of the total production, but at the present time it is at least twelve per cent. because of the reduced production being handled by the same equipment that formerly handled much larger quantities of coal. Between 46 per cent. and 50 per cent. of the coal produced in Nova Scotia during 1918 was therefore used by the operating companies in connection with the collieries and the associated steel plants. In Cape Breton Island the amount of coal consumed locally is proportionately greater because of the location of the steel plants in the Island. It will run close to sixty per cent. of the total production.

Falling Off In Production

At the outbreak of the war, roughly two million tons of coal per year was being shipped from Nova Scotia—chiefly from Cape Breton Island—to St. Lawrence ports. In 1917 not more than 50,000 tons were sent up the river, and in 1918 no coal at all reached the Montreal market by water, although a negligible tonnage was sent by rail to points in Quebec from the collieries at the extreme western end of the province.

A perusal of the tabulation given above will show that the decline in outputs has chiefly affected the larger companies, and there has been an increase in the aggregate output of the smaller operators. A number of new openings into crop areas, or easily accessible areas that are unprofitable in normal times, have been made, and a tonnage of coal has been secured that has greatly assisted in supplying local needs. These enterprises have been occasioned by unusual conditions of coal shortage and high selling prices, and they cannot be regarded as permanent additions to the productive capacity of the Province. They will disappear when the conditions that have brought them into existence pass away.

Prospects None Too Bright

The outlook for the coal industry is not hopeful. The reduction of almost one-third in output has not been accompanied by a corresponding reduction in the number of workmen employed, because the shortage of men that has brought about the reduction in outputs is confined to the producing or miner class of employee. Wages have advanced from 75 per cent. to exceeding 100 per cent. over the basis of 1916. Materials have advanced correspondingly in price. Overhead expenses have increased during the war period because of the decreased ratio of production, but also because of the addition of new imports in the nature of taxation, local rates, a Provincial Workmen's Compensation Act, and the alteration of the previous system of fortnightly pays at the collieries to weekly pays. This last named alteration has largely increased the clerical staffs at the collieries. Physical conditions of extraction are also becoming yearly more difficult, because of the larger percentage of submarine coal that is being mined, and must in future be mined if the production is to be maintained.

Not Getting The Results

The factor that is at the present time reacting most detrimentally on the industry is the inefficient nature of the colliery working forces brought about by the unduly small percentage of men working at the coal face. If the number of miners actually digging coal can be restored so as to properly balance the auxiliary workers engaged in the handling and preparation of the coal, then simultaneously production costs will be lessened and production will increase.

Wages of miners were increased at the beginning of 1918, and again on the 1st of July, and it is intimated that a further increase is to be asked by the workmen effective on the 1st of January. As the maximum selling price for coal allowed by the Fuel Controller is already in several instances lower than the cost of production, it does not seem possible that further increases in wages can be granted, and it will be difficult for the miners to justify their request on the ground of the increased cost of living now that hostilities have ceased and the process of deflation in values should become operative; apart altogether from the conclusive fact that operators cannot spend more on production than they receive for the coal sold.

Predictions Came True

In the writer's review of the coal and steel industries, which appeared in CANADIAN MACHINERY last year, it was stated that some of the less remunerative collieries would be compelled to cease operations. This did actually happen during the year, and it is possible, indeed probable, that other collieries in Nova Scotia must cease operations during 1919, unless either the costs of production are markedly decreased or much higher selling prices are obtainable than is the case to-day.

The Amalgamated Mine Workers of Nova Scotia have declared their intention to affiliate with the United Mine Workers of America. It is quite certain that the coal operators will object to this as they did in 1908-9, and in order to stoppages of work as at that time took place, it is stated that a confernce is being arranged between representative operators of the province and leading officers of the United Mine Workers of America to arrive at some understanding.

Speaking generally, the prospect before the coal trade in Nova Scotia is very troubled. There seems very little reason to expect any increase in coal production, although it is understood that the military authorities propose to release a number of Nova Scotian miners at an early date, and these men should help production, always provided they are skilled workers, because, as has been pointed out, there is already a surplus of non-productive labor at the collieries. It is probable that the return of miners to the collieries will serve to offset and

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arrest the declining tendency of the outputs, but this is probably the best that can be hoped for, and it may be anticipated that the production of coal in Nova Sotia during 1919 wil not exceed the figures of 1918.

The Steel Trade of 1918

Tne course of the steel trade during 1918 has been marked by a gradual lessening of activity in the manufacture of shells and shell steel, and an increase in ordinary business. This tendency preceded, and to some extent foreshadowed, the coming of the armistice, and it has served to lessen the severity of the readjustment which is now taking place. A period of uncertainty is now being experienced, and some definite and vigorous leads from the Government will be required to carry the workers through the lean months that seem likely to intervene between the cancellation of munitions orders and the booking of commercial orders under the unaccustomed conditions of an open market. It seems to be generally felt that the necessity and the demand for steel and steel products exists and must be filled, but there is a hesitancy in business that may lead to demoralization and unemployment, while employers and customers are waiting for something to turn up, unless a vigorous leadership is given by Ottawa. The whole resources of the nation in manpower and material have been monopolized by the Government during the war period. The initiative of the corporation and the individual has been largely destroyed, and the Government having assumed control of industry under admitted national necessity, must also undertake to reverse the wheels of control until such time as corporate initiative and the operation of natural laws of supply and demand can be recovered. There is no magic in a Government, nor can it perform miracles, but, if under the stress of necessity, a Government leads the country along an extraordinary course, it must also, under the stress of equal necessity, guide the country back into ordinary and maybe humdrum paths.

New Equipment Added

Enlargement of plant and new construction during 1918 includes the completion of two batteries of Kopper's bye-product coke-ovens for the Dominion Iron & Steel Cmpany in Sydney, and the completion of the reconstruction of No. 1 Blast Furnace. The erection of the new plate-mill is proceeding, excavation work being completed and foundations well advanced. The erection of this large plate mill at Sydney marks a stage in the progress of this country towards national self-reliance, and is a logical addition to Canada's steel industry. It is a courageous proceeding, and is perhaps a better illustration of Government than of corporate initiative. The Government, having been so largely responsible for the erection of this mill will naturally be required to foster its commercial success, and this is one illustration of how Government initiative and interest, originating in war-time measures, must be continued into the less exciting times of peace.

The Nova Scotia Steel & Coal Company completed a new blast furnace at Sydney Mines, intended to serve as a spare furnace, but it has not yet been found necessary to place the new furnace in blast because of the unusual length of service being obtained from the lining of the older furnace.

The outlet for steel products, now that the necessity for munitions steel has disappeared, is expected to come largely from the requirements of railway and water transportation, on both of which great inroads have been made by the interruptions of supply and the wastage occasioned by the war. The Dominion Iron & Steel Company has been rolling railway rails to the order of the Canadian Government since early in the year. The Nova Scotia Steel & Coal Company have during the year completed the building of the SS. "Watouka," making the third steel vessel which has been built at New Glasgow during the war. It is understood that two more steel vessels of 2,800 tons each are to be immediately laid down at New Glasgow. The "Watouka" was launched during the early part of December and is now fitting for sea.

It is anticipated that orders for freight cars will be received by the Eastern Car Company from the Government in the near future that will enable this plant to operate successfully for some time to come.

Since the signing of the armistice there has been a large readjustment of employment in the neighborhood of New Glasgow, and between 800 and 1,000 men have been released by the cancellation of munitions orders at the Trenton plant and in the numerous small shell plants that were centred in Pictou County.

Surprisingly little disturbance of labor conditions has been occasioned so far by this adjustment, which is probably owing to the fact that the labor employed in munitions manufacture was largely drawn from the surrounding country districts, and the workmen have returned to their homes, and have to some extent found employment in lumbering operations.

While there is an underlying feeling of optimism regarding the future of the local steel industry, because of the general soundness of Canada's industrial position, and the feeling that the restriction of building operations, of railway extension and upkeep, and the development of public and corporate works, that was imposed by war conditions during four years past, must have created a demand for steel in various commercial forms that will eventually manifest itself just so soon as business confidence is restored, it is evident that there will be a pause between the cessation of work on war orders and the commencement of work on regular commercial lines that can only be shortened by a judicious fillip administered from Ottawa.

Steel is King When the Nation Goes to War

Industry Was All Marshaled For Winning of the War—The Trouble Was in Locating the "Bottle Neck" and Keeping Stopper Out—Investors Waiting For the Prices to Come Further Down

By B. E. V. LUTY, Pittsburg Correspondent of CANADIAN MACHINERY

PITTSBURGH, Dec. 26.—A keynote thought, which will serve at once to explain much that developed in steel distribution during the war, and also to furnish a line on the situation produced when the war closed is this, that steel is the basis or backbone of modern industry. It is not primarily or chiefly a weapon, but rather performs important functions in nearly all the activities that are essential in conducting modern warfare. The idea that steel is chiefly a weapon, offensive or defensive, is a relic of the middle ages, when the armorer was more important than the blacksmith.

That there is much to explain about steel's connection with the war is obvious. One is entitled to an explanation, for instance, or how it was that priminent steel men, some of the brightest and most broadminded in the industry, were engaged for several months after the United States declared war, on April 6, 1917, in attempting to make estimates of how much steel would be required for war purposes. These estimates, which the writer endeavored at the time to follow carefully, ranged from 10 to 35 per cent. of the total output. The mental attitude, moreover, was that this amount of steel was going to be subtracted from the general supply, so that, once the percentage was determined, as many men thought they could do, one would be able to see how scarce steel was going to become. If the proportion was only 10 per cent., the difference might not be noticed, but if it was as much as 35 per cent.. then steel would become very scarce for peace purposes.

Why Steel Was Scarce

In the retrospect all this looks foolish, but equally foolish appraisals as to the future will be made if the fundamental or keynote principle is not faced squarely, that steel is the basis of modern industry, and industry was all marshaled for winning the war. Steel was very scarce during the war, but it was not scarce simply because a large tonnage was shot away in the form of shells, or went into gun manufacture. The coal mines worked as never before, and used much steel. Many cars and locomotives were built. Public service corporations were strained to furnish more current than ever before. Tools of all sorts were in great demand for carpenters, blacksmiths, machinists, and all trades. Tremendous quantities of machine tools were required. Motor trucks and passenger cars were required. These are all peace goods. Airplanes were not commercial before the war, but they are now, for during the war the United States Post Office department established one aerial mail route and lately it has established another, with others to follow.

It took a long time, as a matter of fact, for it to become clear that all steel was needed for winning the war simply because it was not realized that practically all industries were going to be put in line to help. Late in 1917 some of the steel producers felt that within a short time steel would become plentiful, because, apparently, so many of their customers would have reduced demand.

B. E. V. LUTY

When steel production was so greatly curtailed by the transportation breakdown last winter these observers felt that the time for steel to become plentiful was merely postponed two or three months.

What occurred was that while many customers of the steel industry lost much of their ordinary business, the Government gave them orders requiring the same goods they had previously been making, or goods merely of a slightly different description, and they became customers of the steel industry again.

The Pressure Was Applied

J. Leonard Replogle, director of steel supply, was continually calling for more steel. About April 1, 1918, he redoubled his efforts and insisted to the steel producers that they would drop all considerations but that of furnishing steel for winning the war. At a meeting of the steel industry, April 26, a "100 per cent. efficiency pledge" was taken. The War Industries Board then proceeded to take complete charge of the production and distribution of steel. On May 17 a joint committee of the board and of the industry was appointed to study the whole matter on a practical basis. June 6 the board promulgated comprehensive regulations, greatly extending the priority list and establishing, to follow the priorities, a "list of purposes entitled to preferential treatment." If any steel should be left it would fall into what was afterwards designated as Class D, and could be shipped for purposes not designated as essential, upon the securing of a written permit from the Director of Steel Supply. It became clear that the chief function of this regulation was to discover steel for which there was no designated use, whereupon the War Industries Board would divert it to some priority or preference use.

Tremendous Amount Asked For

The Director of Steel Supply first estimated the steel requirements for the second half of 1918 at 20,000,000 net tons in the form of finished rolled product, while he claimed the maximum production attained in any half year had been only about 16,500,000 tons. Later he raised the estimate to 22,000,000 tons, and still later expressed the belief that the requirements would more likely prove to be 25,000,000 tons. Just here it is interesting to note that if production in December were at the same rate as in November the half year's output would be about 18,500,000 net tons, thus it is evident that the supply was not equal to the programme mapped out. The steel desired for all the more important uses had been estimated at the maximum that it seemed possible to use, and it did not prove possible in all cases to use the maximum. A chain is as strong as its weakest link, but in designing the war chain the effort was made to have each link as strong as possible. Thus, in shipbuilding, there was pressure for a supply of steel for the rapid putting of steel into hulls, and for a maximum supply of boilers, engines and other appurtenances. As time passed it developed that the weakest link in the chain was the supply of equipment. Hull launchings ran far ahead of vessel completions, and steel accumulated between the plate mill and the shipway. To change the simile, the "bottle neck" was the supply of equipment, but no one could have told in advance that it would be there rather than somewhere else. Without so much pressure for steel the bottle neck might have been there instead. In the matter of shells there were corresponding experiences. Early in 1918 the bottle neck was in forging capacity for large shells; later, with a large increase in forging

capacity there was a good supply of forgings, and there was one time when, on account of shortage of shell steel, where the bottle neck appeared to be temporarily, supplies to certain forge shops were curtailed, but the machine shops had supplies of forged material up which to draw.

No Famine in Domestic Lines

Reverting to the fundamental idea that steel is the basis of modern industry, and nearly all industries were called to the colors, so to speak, it becomes plain that the end of the war could not find the country bare of steel all along the line. The chief customers of the steel industry had been well supplied with steel. It was not the direct customers who had been denied steel. His customer, in turn, may have been denied the finished product, and that is where the scarcity, if any, would develop. Lawn mowers would have become very scarce because the lawn mower factories were expected to turn out something useful for the war. Stoves for the civilian population became somewhat scarce, though the effect was barely noticeable, because stove factories were making stoves for the Government. Stocks of steel in jobbers' hands were strictly controlled, and the civilian population could not get their usual supplies. Automobiles did become very scarce, while the demand continued. The result was that when the armistice was declared and the restrictions on the manufacture, distribution, and consumption of steel were removed, the chief new demand that came to the steel trade was from the jobbers and the automobile manufacturers. Other customers continued to require steel, but at reduced rather than increased rates.

With the great majority of consumers of steel busy helping to win the war in one way or another, and many of them supplied with more steel than usual rather than less, one may ask how it was possible to find also the steel that was used directly in warfare, for there was a large tonnage so used, for shells, guns, transportation in France, warehouses on both sides the Atlantic and for the extensive shipbuilding programme.

Where the Axe Was Applied

Where was this steel found? It was found by the almost complete stoppage of construction work that was considered unessential. Now in normal times perhaps half, probably considerably more than half of the steel produced goes into permanent construction, in other words into investments. A clear distinction must be made between the two uses of steel. No exact line can be drawn, but broadly speaking the distribution of steel in normal times involves two classes, the first represented by things like the following: Tin cans, tools, household utensils, repairs, etc., etc.; and second, bridges, office buildings, hotel buildings, factories, public service establishments, railway rolling stocks, etc., etc. Consumption along the first line continued, while consumption along the second line was practically cut off, except where the war required it.

While the War Industries Board placed a ban upon building, however, it must not be thought that otherwise building would have continued to any extent. High costs all along the line furnished their own damper, and the War Industries Board with its prohibition merely caught what was left.

When Will Costs Come Down?

The question now is, when will costs be such that investments will be undertaken? We have seen that the ordinary consuming industries were not, in the main, starved as to steel, but rather were fairly well supplied. Some of them will require less steel, at least for a time. The steel that ordinarily goes into investments was diverted to direct war use. The investment buying must return. The demand for steel is already light, and it will grow lighter, week by week, as those whose accumulated wants are filled. Some observers in the steel trade think production may drop to 60 or 70 per cent. of capacity, perhaps before the new year is many weeks old. Almost everyone believes that eventually there will be a very heavy demand for steel, but that will come only when the investor has come into the market.

This matter of the investor is a very complicated one. The investor thinks only of the total cost of his investment. Taking the average or typical investor, and considering him broadly, whether he is the head of a new enterprise or merely a subscriber to so many shares of stock, or whether he is a municipality contemplating improvements, or an existing corporation thinking of making an extension, the investor thinks of the total cost of the investment, of which more anon. He must set this estimated cost against two things, first, the pre-war price that his competitors had for a new factory or a new hotel or office building will have to compete with those already in existence, and second, the prospective cost of the same investment six months, one year, or two years later. If 10 per cent. of the capital can be saved by waiting six months, or 20 per cent. by waiting a year, the best thing to do is to allow the money to lie at interest until it will buy more. Suppose for argument, that costs are never going to come down, that is not sufficient to start investment buying. The investor must first assure himself that with his high cost investment he can compete with the lower cost investment already in the field. Next, he must be convinced of this fact that costs are not going to come down. Professor Smith, the eminent economist, or John Jones, president of the Blank Steel Company, may be convinced, but if Joe Brown has the capital it is Joe Brown who must be convinced.

Many Costs Make Up Total

Now as to the cost of the investment. Mr. Brown considers it as a total. The ordinary investment, that involves the use of steel, requires also the purchase of many other materials and also the employment of much labor. If the total cost has to come down it is not sufficient for the price of steel to come down. Prices of the other materials must also come down before the investment is made if they are going to come down at all. If labor cost is to come down it must also come down before the investment is made. This labor cost is made up of two elements, the basic rate of wages per hour or per day and the amount of service rendered per hour or day. Many employers complain much less of wage rates than they do of the indifferent performance of labor.

Steel prices have come down a trifle and will probably come down more, but that is only one element, no one needs to worry much about the price of steel. The American steel makers are intelligent and will face the situation. They will not be the stumbling block to a resumption of investment buying and they may have considerable room for reducing prices. The reductions in steel prices just made as a readjustment measure make an average, considering all important finished steel products, of about $4.25 per net ton. For the first three-quarters of 1918 the Steel Corporation made deductions for war taxes amounting to between $17 and $18 per ton. and still showed large earnings left. Taxes for 1918 will be lower. As to wage cost, there is room for considerable decrease if the men will work harder, work as they formerly did, without reducing the hourly wage rate. The latter may come or may not, but the former will come.

Halifax.—Owing to the delay in steel shipments from the United States the keels of the first ships to be built in the Halifax Shipyards, Limited, will not be laid until late in January. It had been hoped to lay them this month.

Seattle.—The Northern Pacific district has delivered to the Emergency Fleet Corporation of the United States, between August, 1917, and the end of November this year, no less than 800,000 deadweight tons' capacity in ocean-going steamships. This output was divided between three ports, Seattle, Portland and Tacoma. The number of steamships delivered was 96, made up of 56 from Seattle, 33 from Portland, and 7 from Tacoma.

IRON AND STEEL TRADE IN 1918

THE history of the Iron and Steel Trades during the year 1918, as in the two preceding years, will to most of us read like a romance. While all the Canadian and American mills were last year taxed to their utmost capacity, it is noteworthy that prices were lower than in the two previous years. In 1916 and 1917 prices ran riot—there was no controlling influence, and prices were governed simply by what buyers were willing to pay. It is recorded that steel plates touched 15c per lb. base at the American mills, and tin plates were also sold at $18.00 base at the works. These are record prices. Then came the regulating of prices by the United States Government, when America came into the war, and immediately everything came down to a settled basis. We must remember, however, that the fixed prices applied only to the domestic markets in the United States. The export market was open, and ordinary buyers in outside countries, Canada included, had to pay much higher prices for their requirements. Then came export licenses, priorities and what not, until the most of us gave it up in despair, and had to content ourselves with business which could command high priorities on certain schedules adopted by the American War Board. Dealers were occasionally allowed to import a certain quantity of material for stock under special conditions regarding distribution, but they had to receive authorization from Ottawa before a single plate or tube could be delivered to consumers, even for the most pressing work.

The strain is at last over, and while licenses are still necessary for the export of certain classes of goods from the United States, there is no doubt that conditions in this respect will become normal in the course of the next few months.

The next question to be considered is the probable course of the market over the first quarter of 1919, for it would be idle to hazard any opinion for a later period. Taking into account the present high cost of production, due to high wages and raw materials, it appears to me that present prices on most of the staple articles of iron and steel are extremely reasonable, and afford only a fair profit to manufacturers. Wages will not be reduced by any concerted action on the part of the employers; indeed it would be unwise to attempt any reduction. This must be left to the ordinary economic law of supply and demand, and as the cost of living decreases, so will wages gradually recede to a more reasonable basis, for no one denies that in certain branches of work they have been excessive.

Raw materials, such as ore and fuel, have been contracted for at present prices for the coming winter, so that no reduction of consequence can be made on that score. These conditions apply to the United States as well as to Canada, therefore I can see no reason for any radical decline in prices during the first quarter of 1919, at least. It must be remembered also that stocks in dealers' hands have been reduced to a minimum, owing to the difficulties of securing supplies. I look, therefore, for a fairly reasonable business during the coming winter, and at the end of the first quarter we can revise our ideas on the basis of conditions then prevailing.

Consequent on the ending of the war and the stoppage of the making of munitions and war supplies, certain orders and contracts have necessarily been cancelled, but there has been no desire to cancel orders for general supplies for delivery during the next few months. In any case, it would be extremely unwise either to ask or to accept such concellations. It is very doubtful if buyers could replace their orders at lower prices for some months.

In view of all these facts, I think manufacturers and dealers may look forward to the next few months without anxiety. Business will necessarily be less, but this must be expected, and there will be a welcome relief from the strain under which we have been working during the past few years.

J. T. McCALL.
Vice-Pres. and Gen. Mgr.
Drummond McCall & Co.

Montreal, December 12, 1918.

Canada Cotton Co. Extends.—Work connected with adding another story to the dye house of the Canada Cotton Co., Hamilton, will probably be started at an early date. Many other plants have additions to their buildings in view, according to a report of Building Inspector Whitlock.

Montreal.—A motion is before the Exchequer Court, Mr. Justice Audette presiding, for the purpose of fixing the value of the use and occupation of the McCarthy Shipyard at Sorel by the Canadian Government since December, 1915, at $30,000. The owners fix the value of use and occupation at $80,000.

Rochester, N.Y.—The tug Laura Grace was driven ashore at Grandview Beach off the port of Rochester on Friday morning. The captain, eight men, and one woman reached shore safely in a small boat, and one man was rescued by a United States tug. The Laura Grace left Kingston on Thursday night and ran into a storm, with the result that after an all night battle with the storm the captain lost his bearings and did not find them again until the tug went ashore.

Midland.—No less than twelve boats of the Pittsburgh Steamship Co. will spend the winter at Port McNicoll and Midland. It is unusual for the steamers to use the Georgian Bay ports for this purpose. The boats are each of at least 600 feet long and 12,000 tons carrying capacity, and each ship has at least 480,000 bushels of grain, making a total of 5,760,000 bushels, which will be unloaded during the winter and shipped to Europe. One of the steamers has the largest cargo ever shipped from Duluth, 482,000 bushels, which is now at Port McNicoll.

Collingwood.—The steamer Chester A. Congdon, which went ashore at Chester Rocks, near Passage Island, at the Canadian head of Lake Superior, has the distinction of being the greatest single loss recorded in the lake trade. The steamer and cargo were valued at $1,500,000, the steamer being insured for $750,000, and her cargo, consisting of 380,000 bushels of wheat, valued at $2.35 a bushel. The Congdon was formerly the Salt Lake City, built in 1907, and her tonnage was 10,300 d.w. She was owned by the Continental Steamship Co.

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1—No. 2 S & K Hand Screw Machine. Used.
2—No. 3 S & K Screw Machines. Used.
1—3.4 Cleveland Automatic Screw Machine. Used.
2—2" Cleveland Automatic Screw Machines. Used.
1—No. 515 4-Spindle National Acme Automatic. Used.
4—No. 52 4-Spindle National Acme Automatics. Used.
1—No. 53 4-Spindle National Acme Automatic. Used.
1—1¼ Gridley Automatic. Used.

SHAPERS AND MILLERS

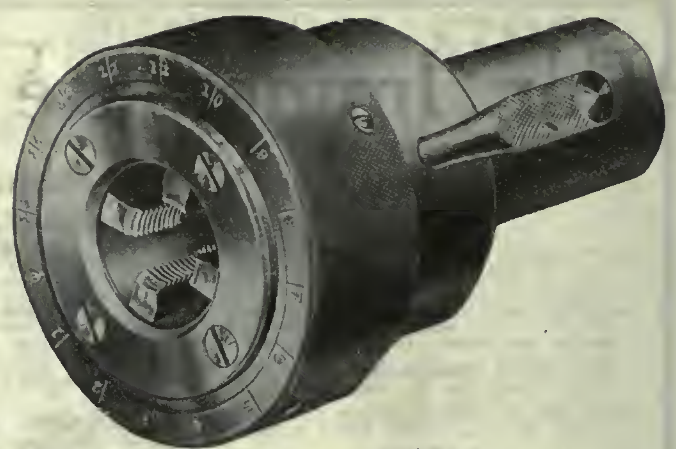
1—25" Springfield H.D., B.G. Crank Shaper. New.
2—16" Springfield B.G. Crank Shapers. New.
2—24" Milwaukee B.G. Crank Shapers. New.
3—20" Milwaukee B.G. Crank Shapers. New.
1—16" Milwaukee B.G. Crank Shaper. New.
2—20" Columbia Crank Shapers. New.
1—16" Fox Crank Shaper. Used.
1—16" Hendy Geared Shaper. Used.
2—14" Hendy Friction Metal Shapers. Used.
1—No. 1 U.S. Hand Miller. New.
1—No. 1 Garvin Hand Miller. New.
1—No. 1 Burke Bench Miller.. New.
1—No. 3 Burke Bench Hand Miller. New.
1—Warner & Swasey Milling Machine. Used.
2—No. 0-B Fox Milling Machines. New.
1—No. 1 Dow B.G. Plain Milling Machine. New.
1—Fosdick 3½" Horizontal Miller. Used.
1—No. 10 Beeman & Smith 3½" Horizontal Miller. Used.
1—60' Bickford Vertical S.H. Miller. Used.

GRINDERS AND PLANERS

2—No. 4 Clizbe Bench Casting Grinders. New.
8—No. 3 Clizbe Casting Grinders. New.
3—No. 2 Clizbe Casting Grinders, on stand. New.
1—No. 3 Champion Bench Casting Grinder. New.
3—No. 0 Champion Bench Casting Grinders. New.
1—No. 3 Detroit Floor Casting Grinder. Used.
1—1¾ x 45" Standard Low Floor Casting Grinder. Used.
1—No. 14 Double End Pedestal Casting Grinder. Used.
1—Iron Fonpdry Builders' Pedestal Casting Grinder. Used.
1—8 x ¾ Casting Grinder on stand. Used.
1—American Drill Grinder. Used.
1—W & M Tool Drill Grinder. Used.
1—Washburn Drill Grinder. Used.
1—Yankee Drill Grinder. Used.
2—W & M Yankee Drill Grinders. New.
1—No. 20 Landis Plain External Grinder. Used.
1—No. 60 Heald Cylinder Grinder. Used.
1—No. 2½ Woods Universal Tool and Cutter Grinder. Used.
1—No. 1 Thomson Universal Tool and Cutter Grinder. New.
1—Cutter and Reamer Grinder. Used.
1—6-A Gorton Universal Disc Grinder. Used.
1—24" Disc Grinder Press. Used.
1—No. 34 Horizontal Disc Grinder. Used.
1—Temco Electric Grinder on Pedestal. New.
1—Temco D Electric Motor Grinder. New.
1—Temco G Bench Electric Grinder. New.
1—Van Dorn Portable Electric Grinder. Used.
1—Hand Electric Grinder. New.
1—P-Tool Electric Grinder. Used.
5—Dumore A.T.P. Grinders. New.
1—Dumore B.T.P. Grinder. New.
2—Dumore G.A.C. Electric Type Grinders. New.
3—Dumore, Jr., Electric Grinders. Used.
1—No. 1 Landis Internal Grinder. Used.
1—Morse Face Grinder. Used.
1—28 x 7 Planer Type Surface Grinder. Used.
1—No. 6 Bryant Chucking Grinder. Used.
1—52 x 45 x 13' 3" Patch 2 Head Open Side Planer. Used.
1—46 x 40 x 13' 2" Patch 2 Head Open Side Planer. Used.
1—44 x 34 x 11' 4" Lincoln 2 Head Open Side Planer. Used.
1—24 x 24 x 6 Wilson Metal Planer. New.

RIVERSIDE MACHINERY DEPOT
25 St. Aubin Ave., Detroit, Mich.

MURCHEY



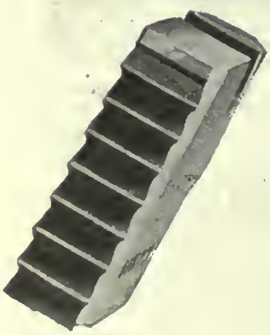
COLLAPSING TAPS AND SELF-OPENING DIES

Clear Free From the Thread

Instantly

—an action that prevents all danger of stripping, besides making a remarkable reduction in cutting time.

The result is closer accuracy and greater quantity.



Murchey Tools are economical, too. They last longer than solid tools and when worn you need merely change chasers. One chaser can be quickly reground while another is in use.

Murchey Service will enable you to speed up production immeasurably on your tapping machines, drill presses, monitor machines, boring mills, turret lathes and on all machines on which taps and dies are attached.

Write for full particulars.

Murchey Machine & Tool Company

75 PORTER STREET, DETROIT, MICH.

Coats Machine Tool Co., London, Glasgow, Newcastle, England; Fenwick, Freres & Co., Paris, France; Iznosskoff & Co.

Purchase in Canada

Quality

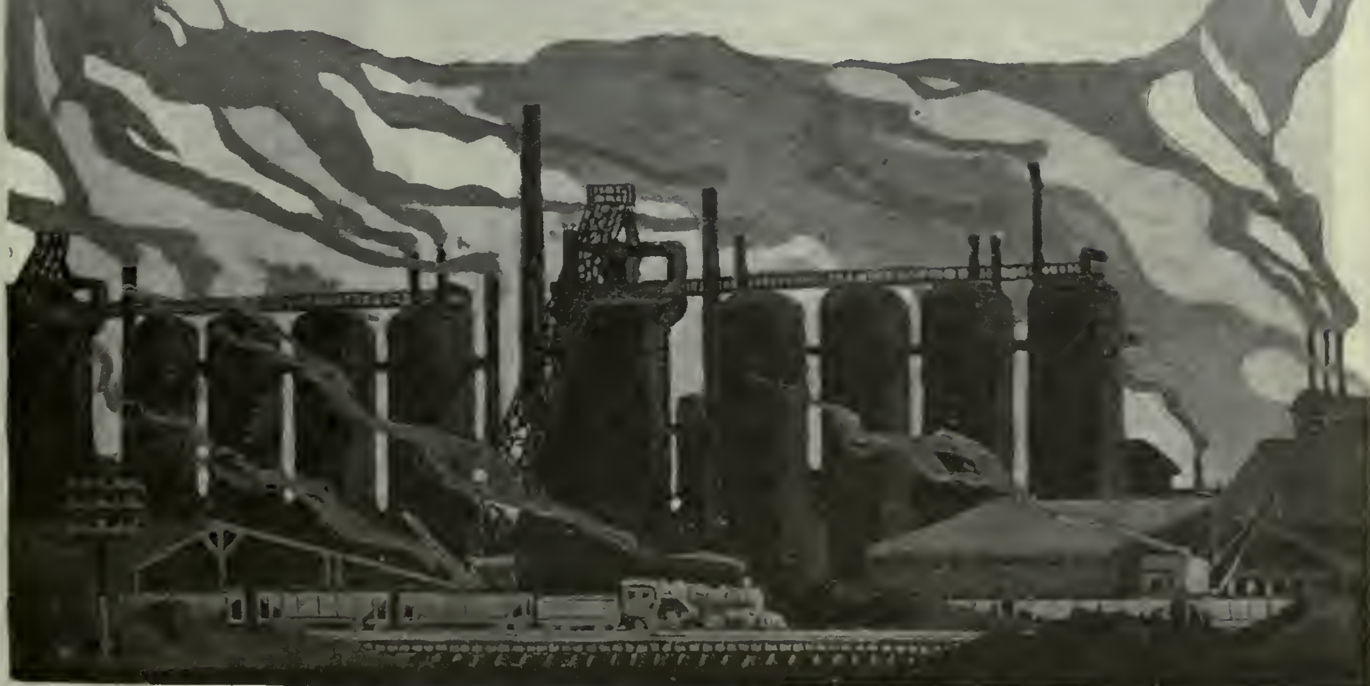
Service

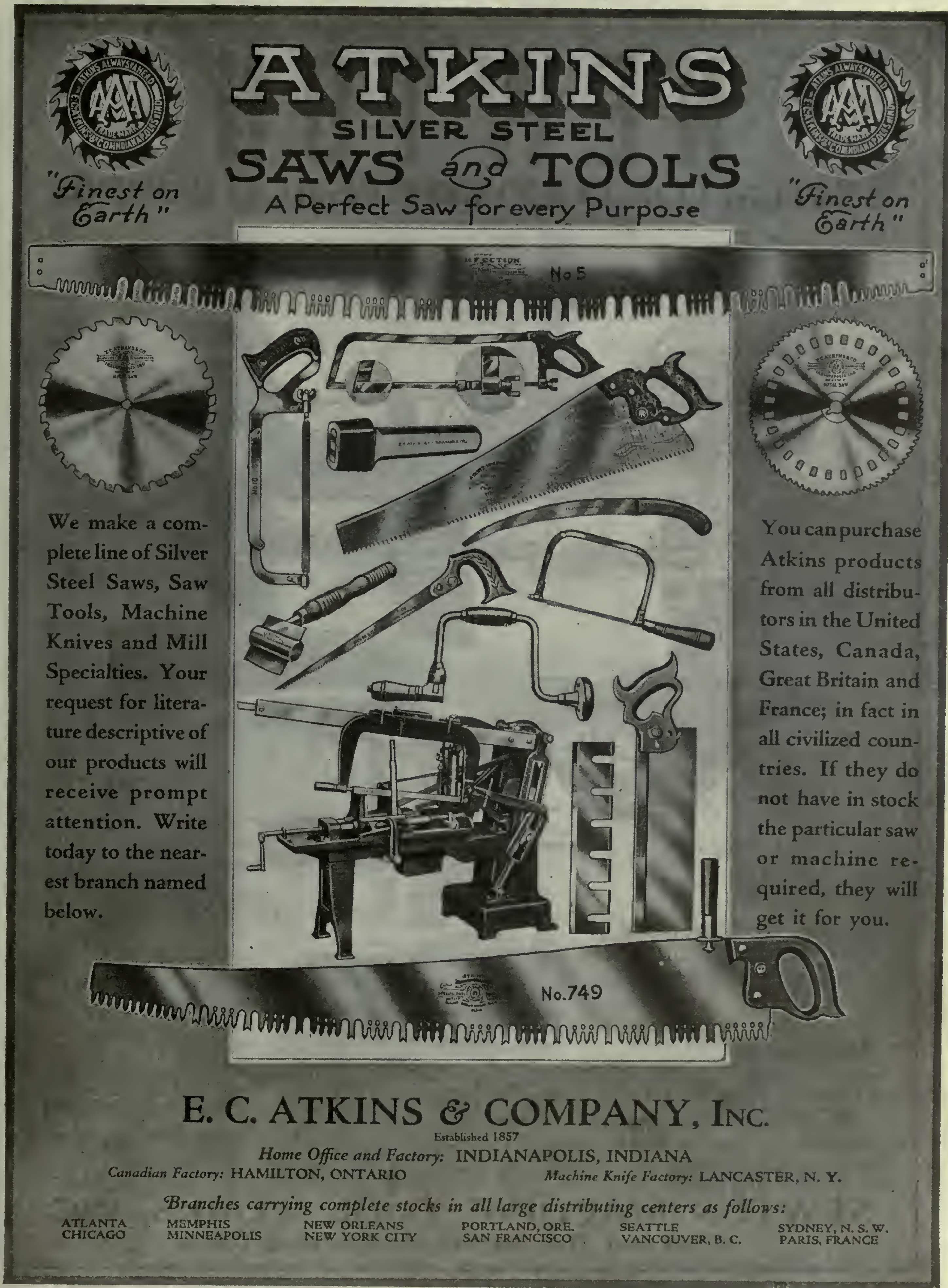
TO UPHOLD THE GLORY we have justly earned—to honor our noble dead—to comfort the wounded, and extend to the men returned the hand of prosperous welcome, we must cast aside all forebodings and face the future with unbounded courage and confidence and, without a shadow of doubt, declare to the World that this Nation, which was so quickly and successfully transformed to a War basis, can be depended upon to revert to Peace conditions with equal success.

THE BUYER AND SELLER must recognize their duty to the Nation and co-operate fully to the end that all products that can be produced in Canada by Canadian workmen shall not be purchased elsewhere.

OUR DUTY IS PLAIN: Canada with Canadian labor and capital can produce, manufacture and distribute products sufficient to keep the wheels of industry turning to the limit. The song of Prosperity and Happiness should ring out all over the land. Let us sincerely pledge, to the extent of our needs, to purchase materials produced in Canada by Canadian Workmen, and the result of our efforts will return to us the Blessings of a Prosperous and Happy Nation.

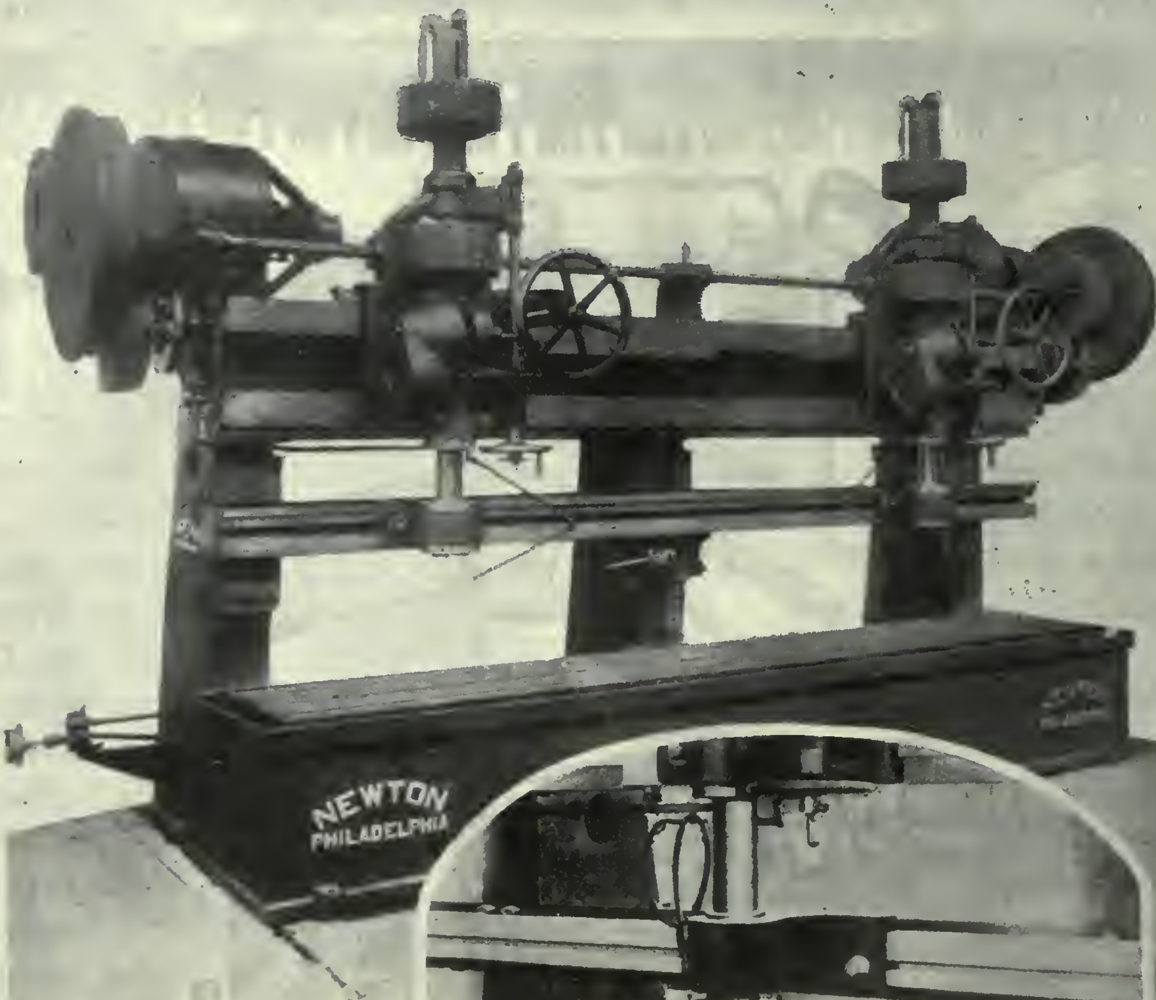
THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

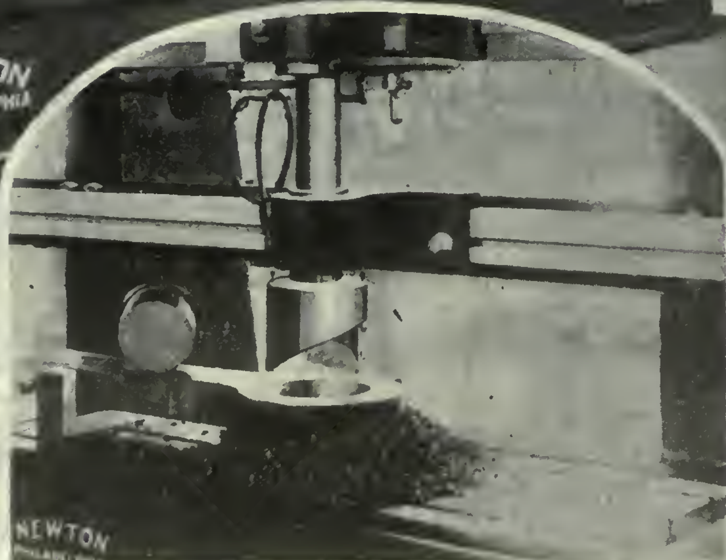



ATKINS
SILVER STEEL
SAWS and TOOLS
A Perfect Saw for every Purpose
"Finest on Earth"
"Finest on Earth"
No 5
We make a complete line of Silver Steel Saws, Saw Tools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest branch named below.
You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.
No.749
E. C. ATKINS & COMPANY, INC.
Established 1857
Home Office and Factory: INDIANAPOLIS, INDIANA
Canadian Factory: HAMILTON, ONTARIO
Machine Knife Factory: LANCASTER, N. Y.
Branches carrying complete stocks in all large distributing centers as follows:
ATLANTA CHICAGO
MEMPHIS MINNEAPOLIS
NEW ORLEANS NEW YORK CITY
PORTLAND, ORE. SAN FRANCISCO
SEATTLE VANCOUVER, B. C.
SYDNEY, N. S. W. PARIS, FRANCE

NEWTON

SYSTEM FOR LOCOMOTIVE ROD BORING





To date we have made 17 installations and are now building sufficient machines to satisfy the requirements of 9 major arteries of traffic. Advantages:

1—Newly-developed hollow cutters dispense with the necessity of drilling pilot holes for boring bars. Drills, material, time and power are, therefore, conserved.

2—Kerf by cup cutters, in no case, exceeds ⅝".

3—Cores removed solid have a tremendously increased salvage value.

4—The exclusive NEWTON lower support makes these economies possible.

5—Two ends of one or one end of two rods are bored at the same time.

6—Twin spindles allow duplication of center distances in like rods.

7—Cross-heads may be reamed to advantage.

8—Odd jobs of heavy drilling may be done with dispatch.

NEWTON MACHINE TOOL WORKS, INC.

23rd and Vine Streets, Philadelphia, U.S.A.

RICE LEWIS AND SON
LIMITED

ESTABLISHED 1847 TORONTO, ONTARIO 19 VICTORIA STREET

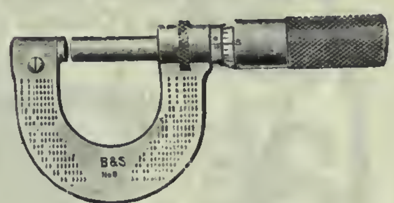
Machine Shop and Foundry Supplies for Greater Peace-Time Output

No one better than you, Mr. Manufacturer, knows that competition in the days to come will be keen. Better materials and more efficient tools make for quantity output—and profit.

Ask for Quotations on Iron and Steel

We have in stock for immediate shipment the highest grade Bar Iron, Black and Galvanized Sheet Iron, Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.

Micrometer and other fine tools



Select from such wholly dependable makes as Starrett or Brown & Sharpe, or from other makes you have proven in your own shop to be most durable and efficient. Our stocks are complete.

CRESCENT BELT FASTENERS

Clinch beneath the surface of the belt on the pulley side—no part in contact with the pulley. They maintain uniform grip the entire width of belt and never weaken from wear.

Machinist's Tool Chests

Time and again skilled machinists have remarked on the strength of construction and compact design of our Tool Chests. Have us give you full particulars.

"Victor" Hack Saw Blades for Tough Metals

Durable, fast-cutting blades that you can rely upon to cut true through toughest metals. Users have found that these blades increase every day's output and serve much longer than ordinary blades.

Write us about your requirements.

RICE LEWIS & SON, LIMITED

Established 1847 TORONTO, ONT. 19 Victoria Street

FORBES

PIPE CUTTING AND THREADING MACHINES

The One-Man Way

WHERE the old stock and die method of pipe cutting and threading required two to four men for each operation the FORBES Pipe Cutting and Threading Machines require but one man.

Nothing larger than 4 inches is ever attempted with a stock and die. One man with a FORBES can cut off and thread all sizes of pipe up to 15 inches. A boy can operate a FORBES on the smaller sizes of pipe with ease and efficiency.

Every FORBES is fully self-contained, and can be carried right to the scene of operations.

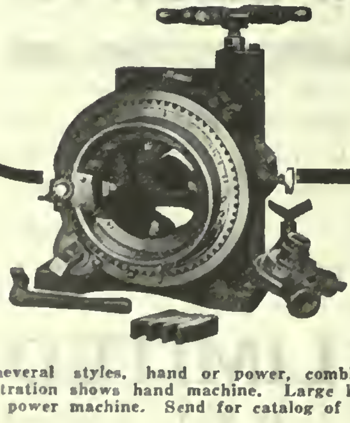
Owing to the simple design of Forbes machines which eliminates the necessity of turning heavy lengths of pipe, they require much less power to operate, occupy half the floor space and cost far less than the ordinary type of lathe bed machines.

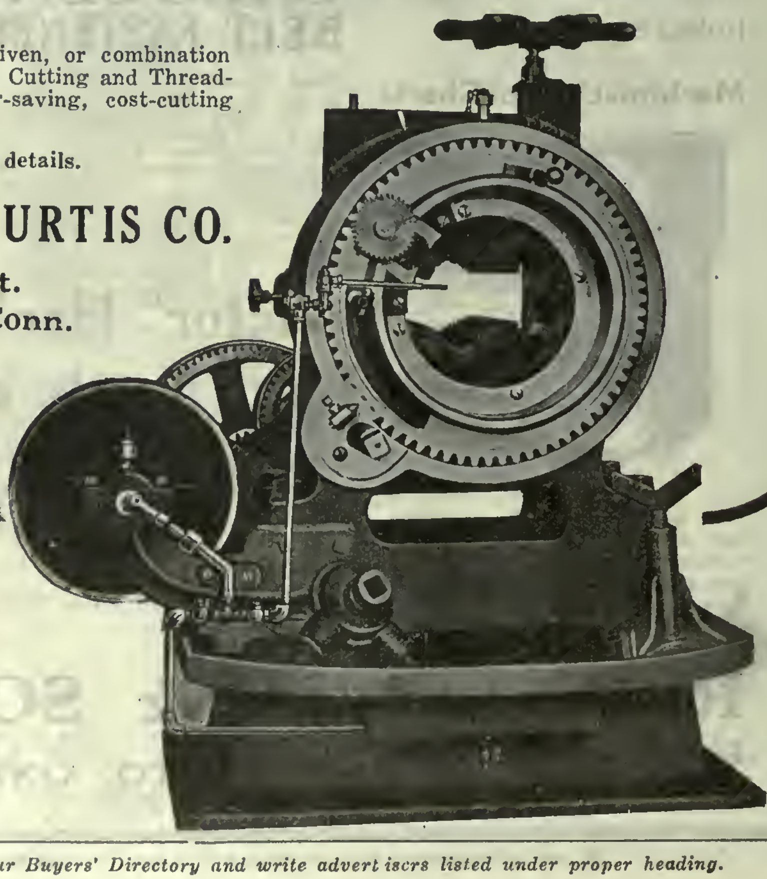
Whether hand-operated, motor-driven, or combination hand and power, a FORBES Pipe Cutting and Threading Machine is a simple, labor-saving, cost-cutting ONE-MAN operation.

Write for the full details.

THE CURTIS & CURTIS CO.

Garden St.
Bridgeport, Conn.
U.S.A.





Made in several styles, hand or power, combination. Small illustration shows hand machine. Large illustration shows power machine. Send for catalog of various styles.

The GEO. F. FOSS MACHINERY & SUPPLY Co
LIMITED
305 St. James Street - Montreal, Quebec

One Great Advantage

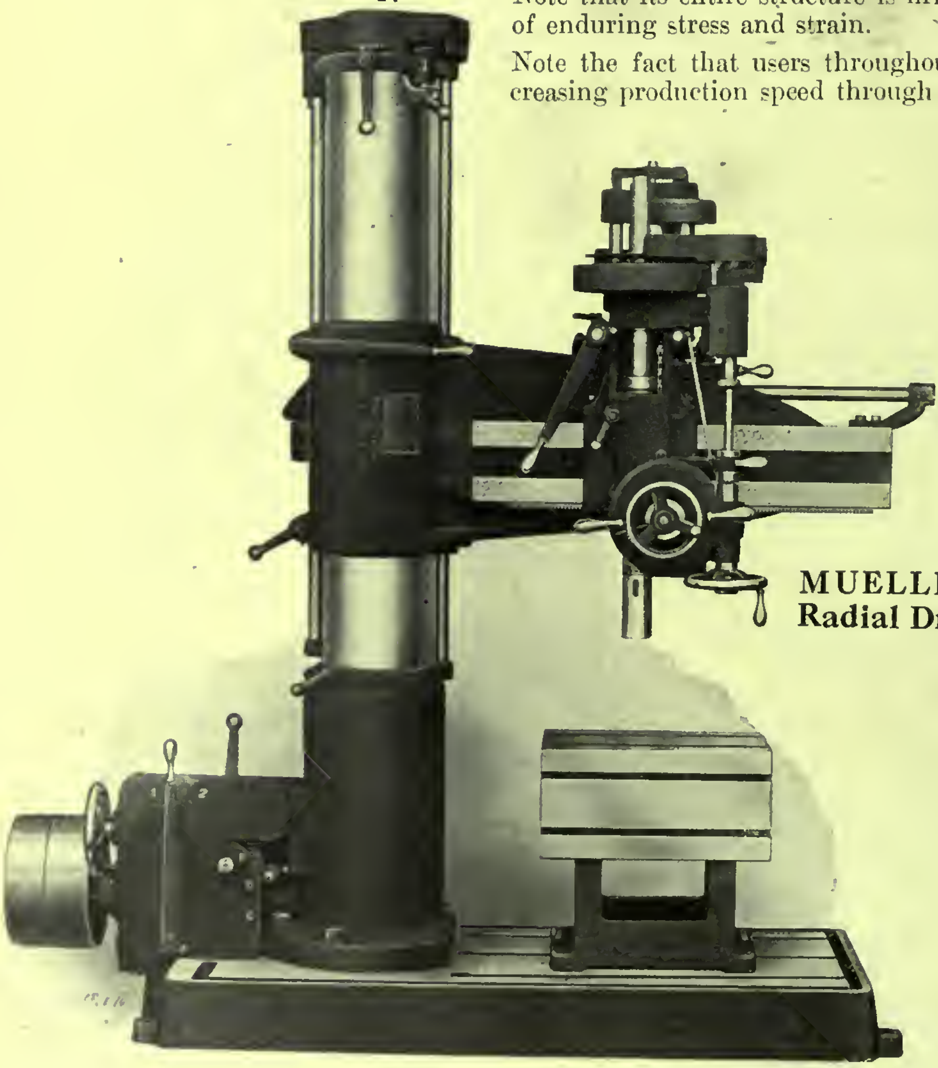
which the Mueller Radial Drill has over other radials is its Patented Stationary Column.

Note its strength—one-piece and stiffened by four internal webs.

Note the fact that every control lever is within easy reach of the operator.

Note that its entire structure is firm, rugged and capable of enduring stress and strain.

Note the fact that users throughout the country are increasing production speed through its use.



MUELLER
Radial Drill

Note the bearing surface of the arm on the column.

The Mueller Machine Tool Co.

Radial Drills and Lathes
Cincinnati, Ohio

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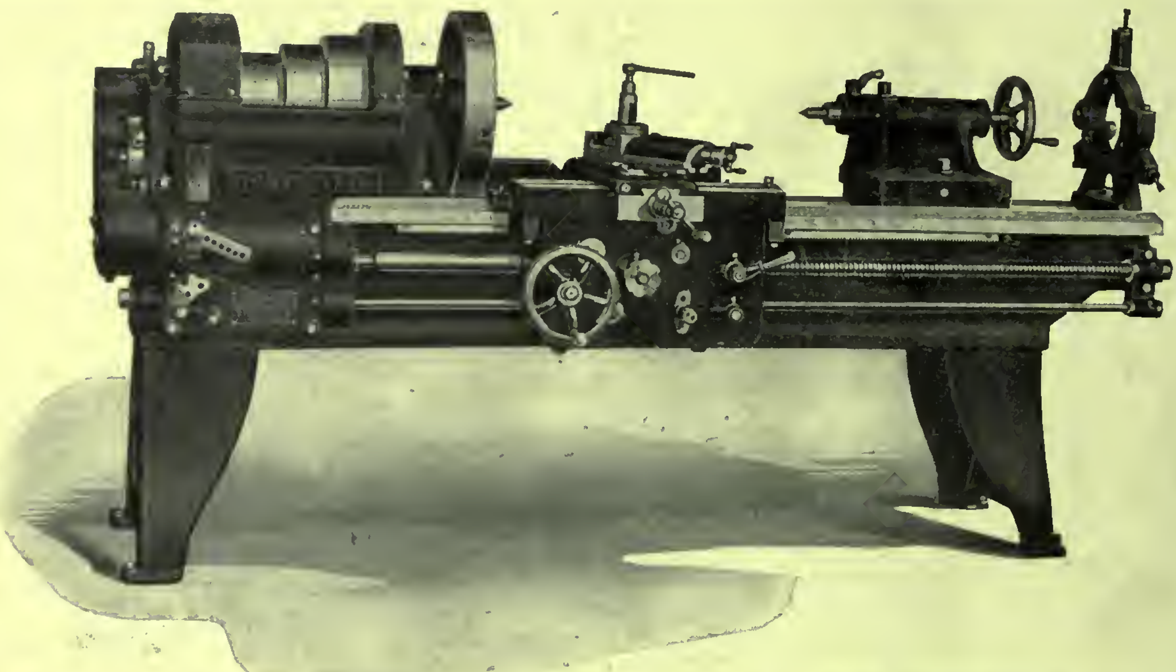
LIMITED

305 St. James Street - Montreal, Quebec



SIDNEY

17 and 19 inch

High Duty Engine Lathe

Entire quick-change gear mechanism mounted on the front of bed, and fixed permanently in accurate alignment by a tongue and groove, is a complete unit in which every gear is made from high carbon steel. The cone gears, because cut with improved 22½ degree angle cutters have pointed teeth slightly rounded at the top—the only gear in tumbler gear mechanism that can and does make instantaneous engagement without interference.

Bed of 25% steel mixture has heavy double wall cross girts, two feet apart. Its rigidity is great, because ordinary construction would not stand up under strain of such speed and deep cuts as this Sidney Lathe is capable of making.

Write for Bulletin that fully describes this big-earning Sidney Lathe.

Sidney for Service

The Sidney Tool Company, Sidney, Ohio

Canadian Agents: The Geo. F. Foss Machinery & Supply Co., Montreal, Quebec. H. W. Petrie, Limited, Toronto, Ontario.

The GEO. F. FOSS MACHINERY & SUPPLY Co

LIMITED

305 St. James Street - Montreal, Quebec.

The Ford-Smith Machine Company

FORD-SMITH

Plain and Universal

Milling Machines

Special Machinery

Water Tool Grinder

Swing Grinders

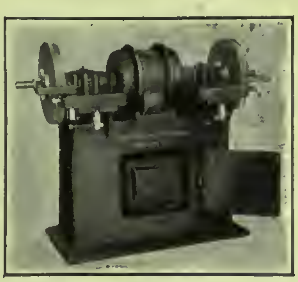
Disc Grinders

Polishers

Write for our latest

Catalogues and Price List

General Purpose Grinder.



Motor Driven Floor Grinder.

We solicit the privilege of quoting on your

Special Machinery

Heavy Type Floor Grinder.

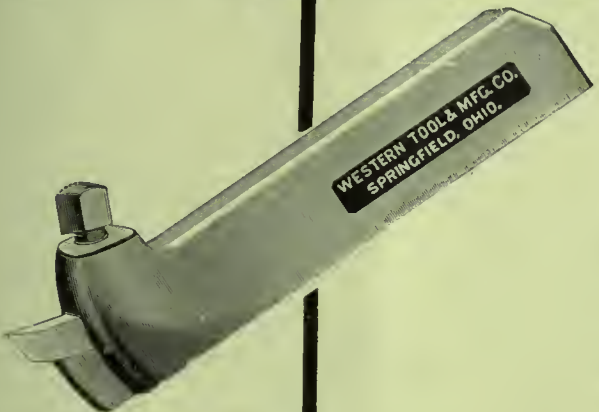
Manufactured by

The Ford-Smith Machine Co., Ltd.

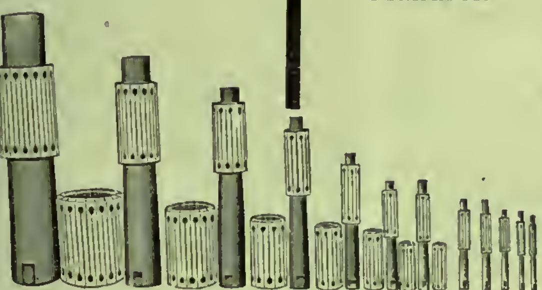
HAMILTON, ONTARIO, CANADA

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

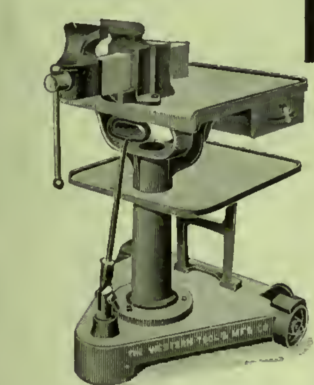
CHAMPION TOOLS



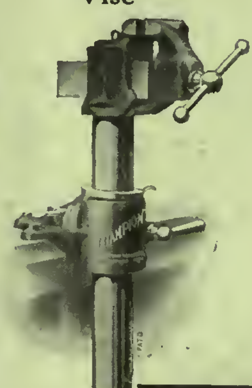
Champion Turning Tool



Champion Expanding Mandrels



Champion Shop Furniture



Champion Vise

BULLDOG JAW AND A BULLDOG GRIP

The "CHAMPION" TOOL HOLDER grips the cutting tool with bulldog tenacity. Note the heavy extended lip which protects the tool. This holder stands up under the heaviest service. It can effect a distinct saving for you in breakage. A further saving is effected with this holder, since it can use up the small ends of cutters. High Speed Steel is expensive and difficult to obtain. Better economize your present supply—make it last longer and turn out more work by using "Champion" Tool Holders.

"CHAMPION" EXPANDING MANDRELS

They have no claws—cannot injure work. They are simple, accurate and low in cost. A complete set as shown makes any size mandrel between ½ and 6½ in. immediately available. They are the ideal equipment for economy in first cost and for the production of accurate work.

SHOP FURNITURE

Including Portable Benches, Steel Racks, Tool Stands, Trucks for moving boxes, heavy castings, etc., Lathe Pans, Steel Boxes, etc., etc.

The "CHAMPION" VISE will easily handle any odd-shaped work as well as ordinary shapes. It is more quickly positioned than any other vise. The work can be kept in proper position before the eyes of the workman in the best light without the necessity of stooping or other tiresome and awkward attitudes at the bench. A long stride toward correct work. Simple—Durable—Accurate.

THE WESTERN TOOL & MANUFACTURING CO.

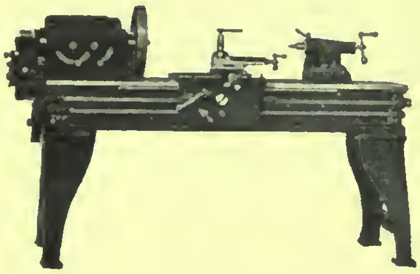
SPRINGFIELD, OHIO, U.S.A.

Also Makers of Emery Wheel Dressers, Vises, Shop Furniture, etc., etc.

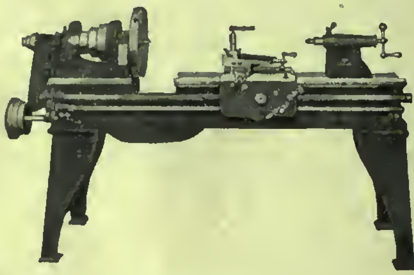
ASK FOR CATALOG

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED

305 St. James Street - Montreal, Quebec



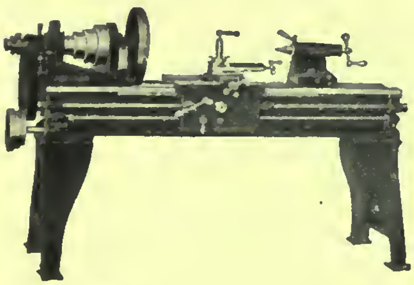
The experience of thirty-years of exclusive Lathe building stands back of our Lathes



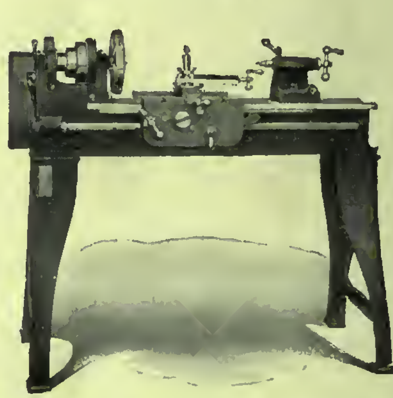
Built in four sizes—10, 13, 14, 15-inch swing

SEBASTIAN LATHES

Geared Head,
Cone Head,
Plain or
Quick Change



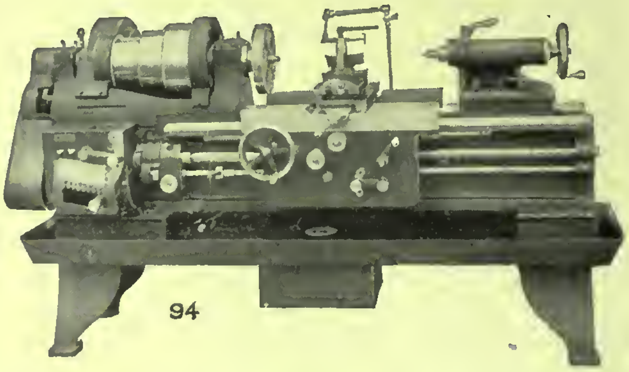
Efficiency demands the best equipment.



Write for complete catalog.

THE SEBASTIAN LATHE CO.
190 Culvert Street : Cincinnati, Ohio, U.S.A.

To Own Our Lathes

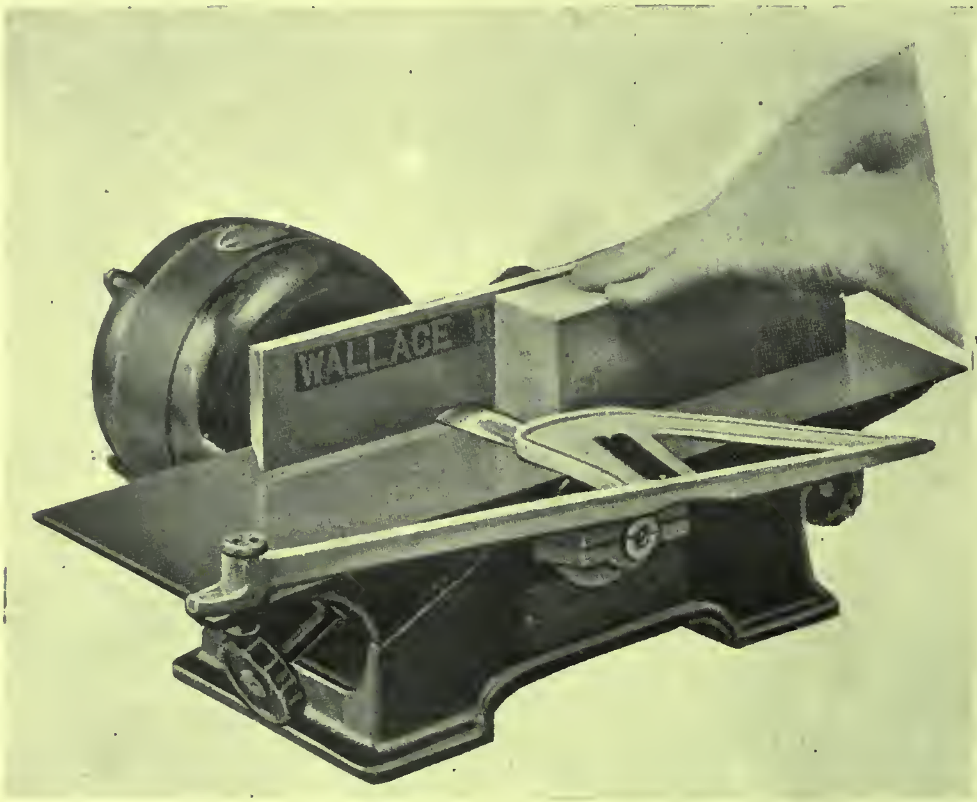


is to have a *Limitless Source* of Satisfactory Service.

In them you get a standard of **many years'** experience that cannot be merely imitated. Latest literature gives full details.

The Cincinnati Lathe & Tool Co., Cincinnati, Ohio

CANADIAN REPRESENTATIVES:
Geo. F. Foss Machinery & Supply Co., Ltd., 305 St. James St., Montreal.



WALLACE Bench Planer

"Speeds Up" Production Cuts Cost

THE bulk—or about 70 per cent.—of your fitting, trimming, jointing or surfacing is on work less than 4 feet long and 4 inches wide. For lack of better facilities you have had to **do** all this work by hand—at an enormous cost. If every operation were as costly you'd close up shop. You can't afford to run to the big stationary jointer with each piece of work —yet that cost must be cut.

THE Wallace Bench Planer was designed especially for small work. It is the quick action machine you need to turn out that bulk of your planing, surfacing, beveling, jointing and fitting efficiently—economically. That's why it's busy in the General Electric, Westinghouse, Reaser Furniture, Long Furniture, Brunswick-Balke-Collender, National Malleable Casting, Pierce-Arrow, Jackson Sash and Door, and hundreds of other shops, from the biggest to the "one man" cabinet, pattern, carpenter shops, etc. In many shops it takes care of **all** the work.

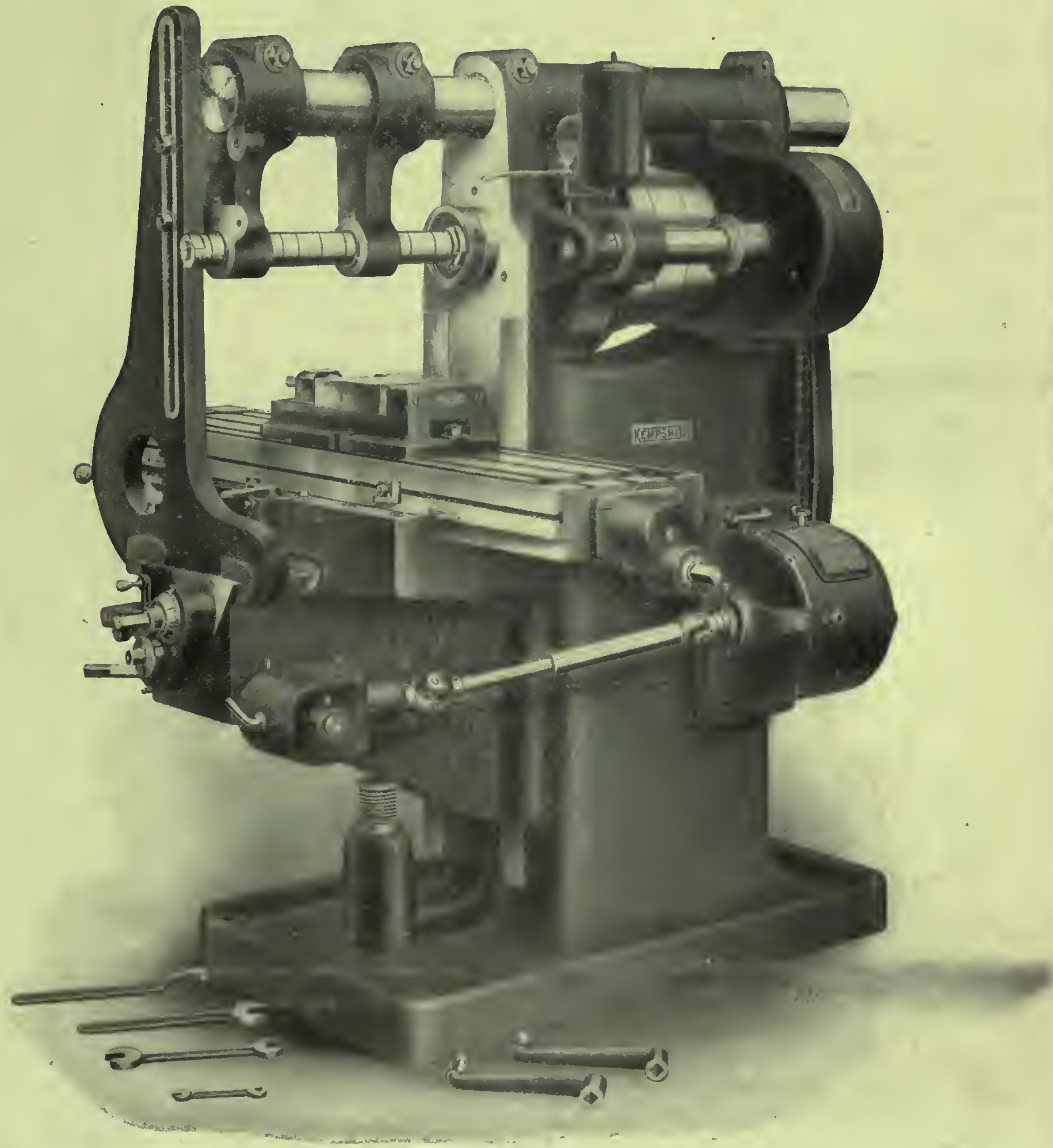
It is portable—works right on the bench—handy at the elbow of your men.

Try this remarkable, simple, cost-saving machine. Stop those daily losses!

The Geo. F. Foss Machinery & Supply Co., Limited
305 St. James Street, Montreal

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec.

KEMPSMITH



KEMPSMITH MILLING MACHINES

Both plain and universal, are built in a wide range of sizes, adapting them for use on all classes of work, ranging from the finest precision instruments up to the heaviest automobile and aeroplane engines, tractors and agricultural machinery.

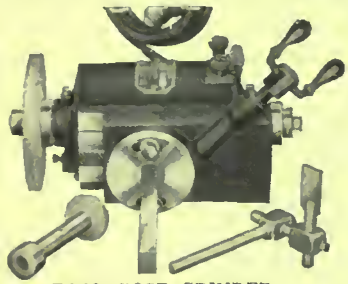
THE KEMPSMITH MANUFACTURING CO.

MILWAUKEE, U.S.A.

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED

305 St. James Street - Montreal, Quebec

Cut Your Costs "CINCINNATI ELECTRICS" Will Do It!



TOOL POST GRINDER
¼ to 3 H.P. Weight from 16 pounds up. Free hand feed. Bearings adjustable to wear. Horizontal and vertical feeds. Different types for all purposes.

BENCH GRINDER OR BUFFER
Five sizes, ¼ to 3 H.P. Also Pedestal Floor Grinder, 1 to 3 H.P. Fully enclosed. Dirt- and dust-proof. Ball bearings.

SPECIAL FEATURES

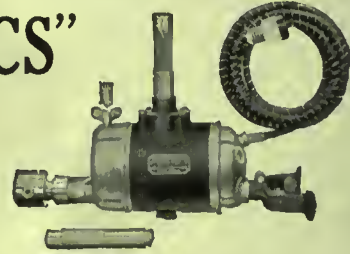
Air cooled. Ball and Thrust Bearings. All working parts hardened. Overload Allowance. Guaranteed Mechanically and Electrically.

Write for Illustrated Bulletins To-day.

CINCINNATI ELECTRIC TOOL CO.
1501-3-5 Freeman Ave., CINCINNATI, Ohio

Canadian Agents:

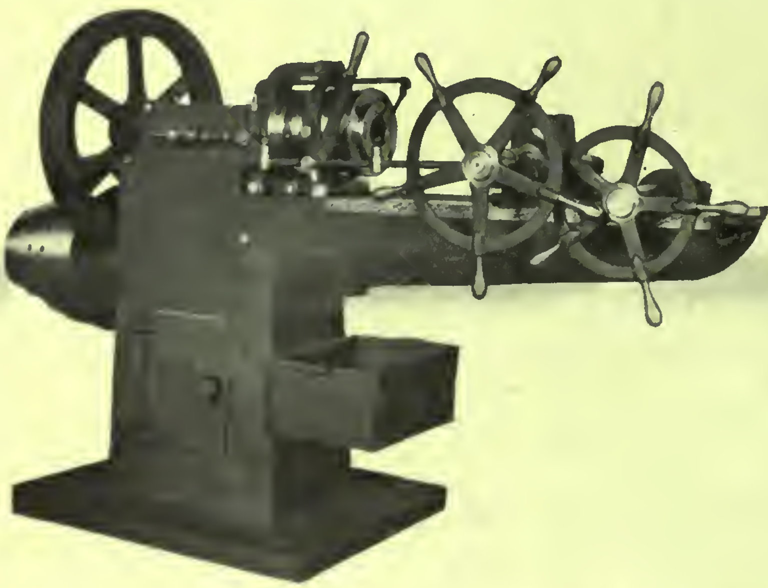
The Geo. F. Foss Machinery & Supply Company
305 St. James St., Montreal, Que.



HAND OR BREAST DRILLS
¼", ⅜", ½", ¾" capacities. Weight from 7 pounds up. Ball and thrust bearings. Gears run in grease. Single and two speeds.

HAND AERIAL GRINDER
For cleaning castings or surface work of any kind. Made in four sizes, ¼ to 2 H.P. Weight from 18 pounds up. Guaranteed for hard usage.

Standard Bolt Cutters



As a result of twenty years' experience we have developed and perfected a die head and control that is second to none.

All parts strong and substantial, yet so sensitive is the micrometer adjustment or set that bolts may be cut over or under size, and dies set to again cut exact size, at the will of the operator.

The adjustments made in a moment's time, and while the machine is running.

Column and headstock cast in one piece, assures perfect alignment and rigidity.

Our machines are standard with a great many large railroads and shipbuilding concerns on account of their simplicity, making them as accurate in the hands of an apprentice as in the hands of an experienced operator.

Made in single, double and triple sizes.

Dies can be changed from one size to another.

The Geo. F. Foss Machinery and Supply Company, Limited

305 St. James St. Montreal, Que.

RACINE HACK SAW

The merit of a world's record in accuracy and economy stamps this machine as distinctive among metal-cutting machines.

The value of the Racine machine has been demonstrated so thoroughly that we will send you any machine you may select upon approval.

Send for our catalogue and make your choice to suit your requirements.

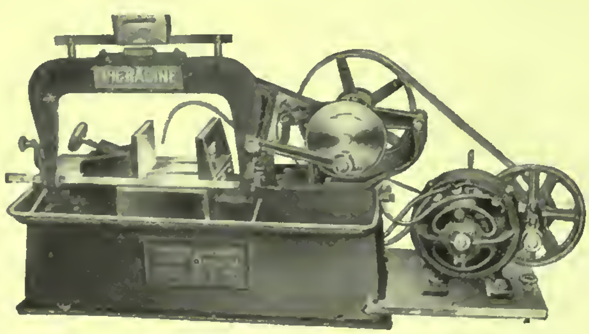
Stock up to 12" x 12". Motor or belt driven.

We guarantee the accuracy of the Racine.

On the reverse the Racine lifts the blade so that wearing on the cutting edge of the blade is eliminated.

We guarantee to keep every machine we sell supplied with Racine H.S. Tungsten Blades.

Racine Tool & Machine Co.
Melbourne Avenue
RACINE, WISCONSIN, U.S.A.



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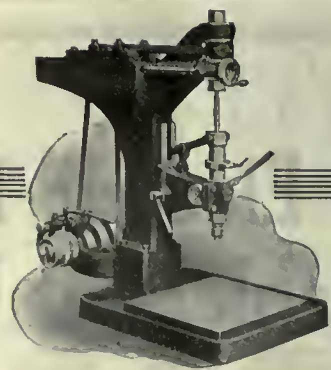

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Our No. 3 machine provides maximum speeds for work up to 1⅛-inch.

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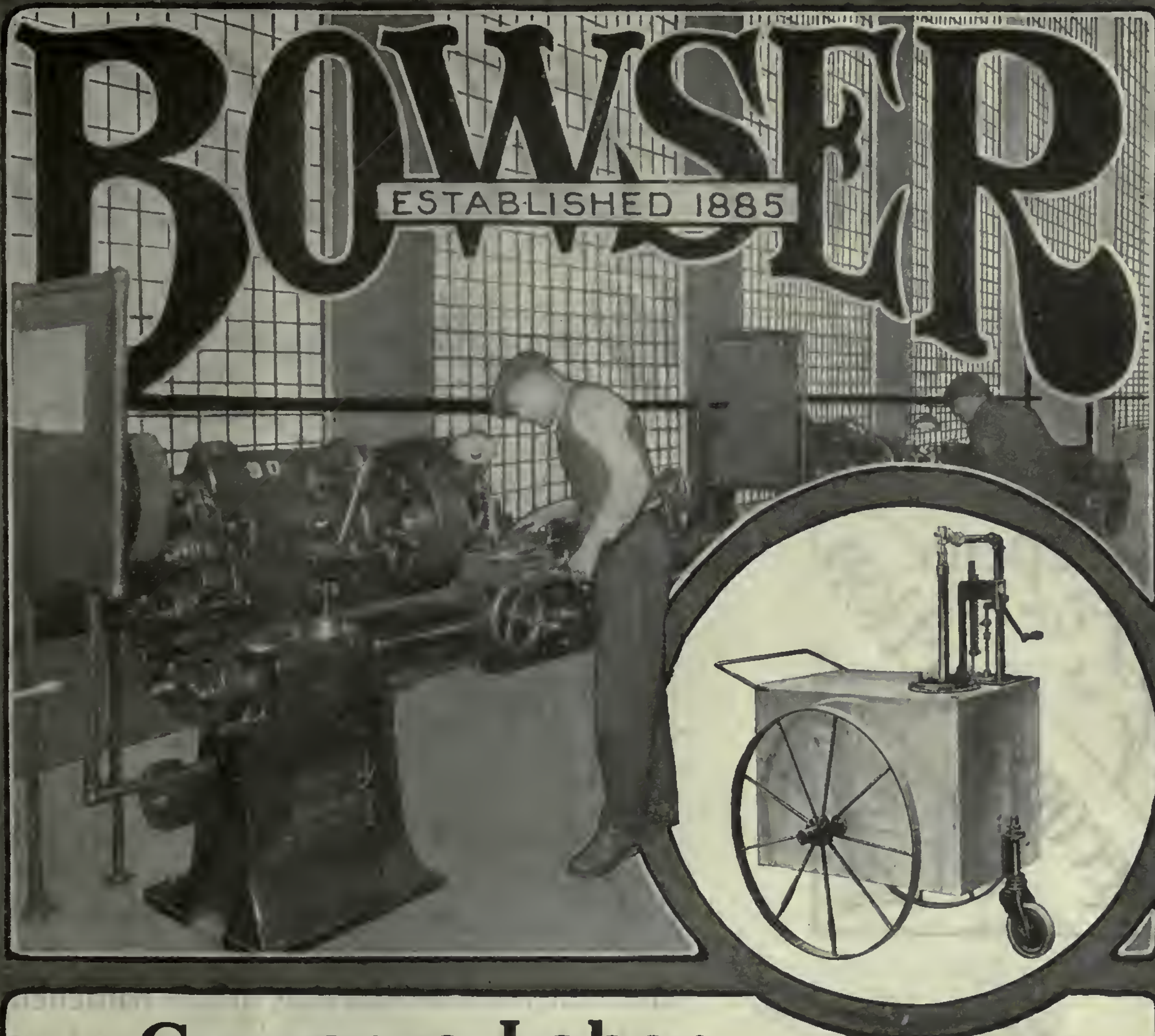
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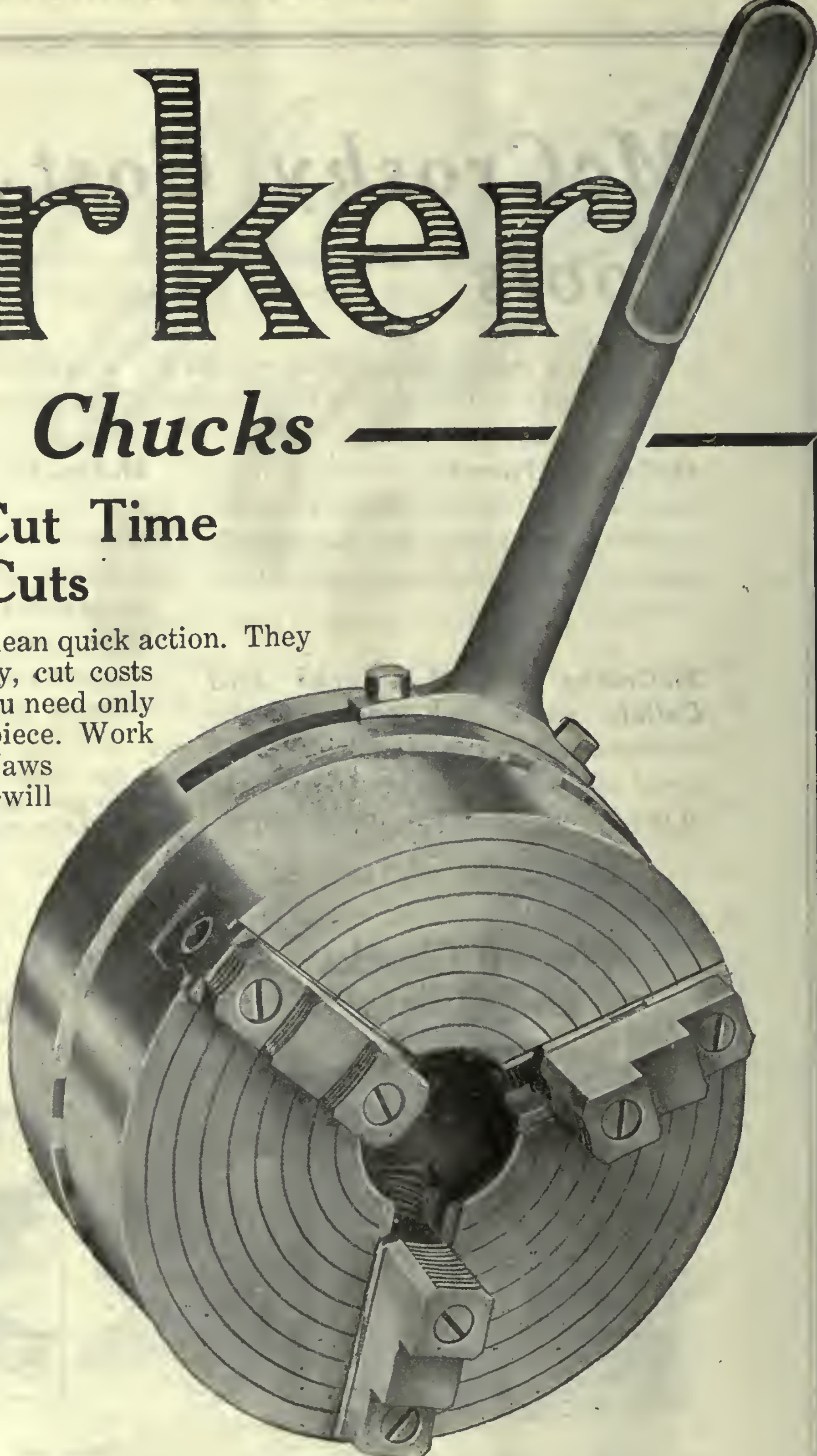
Barker

Wrenchless Chucks

Chucks That Cut Time Between Cuts



Barker Wrenchless Chucks mean quick action. They save hours of time each day, cut costs and increase production. You need only pull the lever and chuck the piece. Work is centered automatically. Jaws grip as tightly as the work will stand.

Jaws are ADJUSTED INDEPENDENTLY to any diameter, in the ordinary manner and for duplicate work, are OPERATED UNIVERSALLY AND SELF-CENTERING by the hand lever while the chuck is revolving or at rest.

The operating mechanism is combined with the chuck proper, forming a single unit. It takes no more time to mount than an ordinary chuck.

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Barker Wrenchless Chucks are exceedingly valuable in every type of work done on turret, engine lathes or semi-automatic machines. It is worth money to you to investigate our chucks. Send for illustrated literature.

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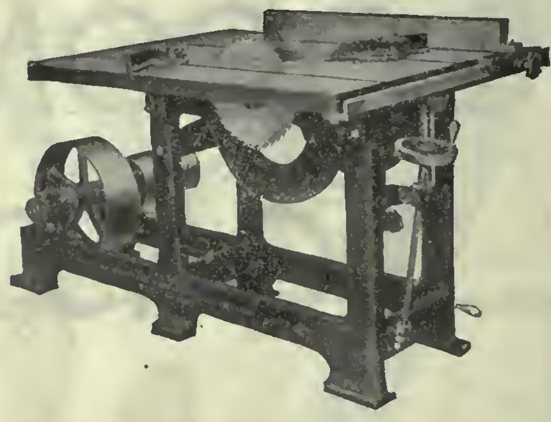

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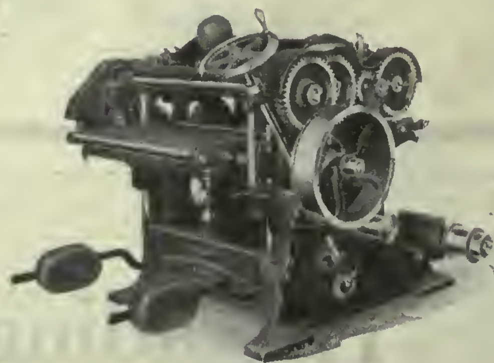
A medium weight machine, very desirable for pattern shop work. Supplied with guard. Capacity up to 3" thick.



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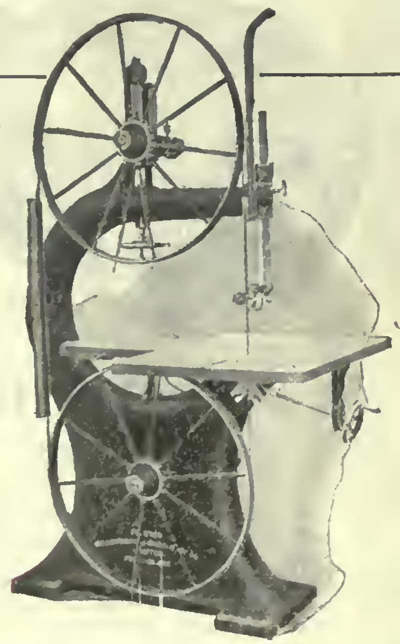
With ground safety cylinder and guard to conform with safety requirements of Government Inspectors.



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Guarded to meet requirements of Factory Inspector.

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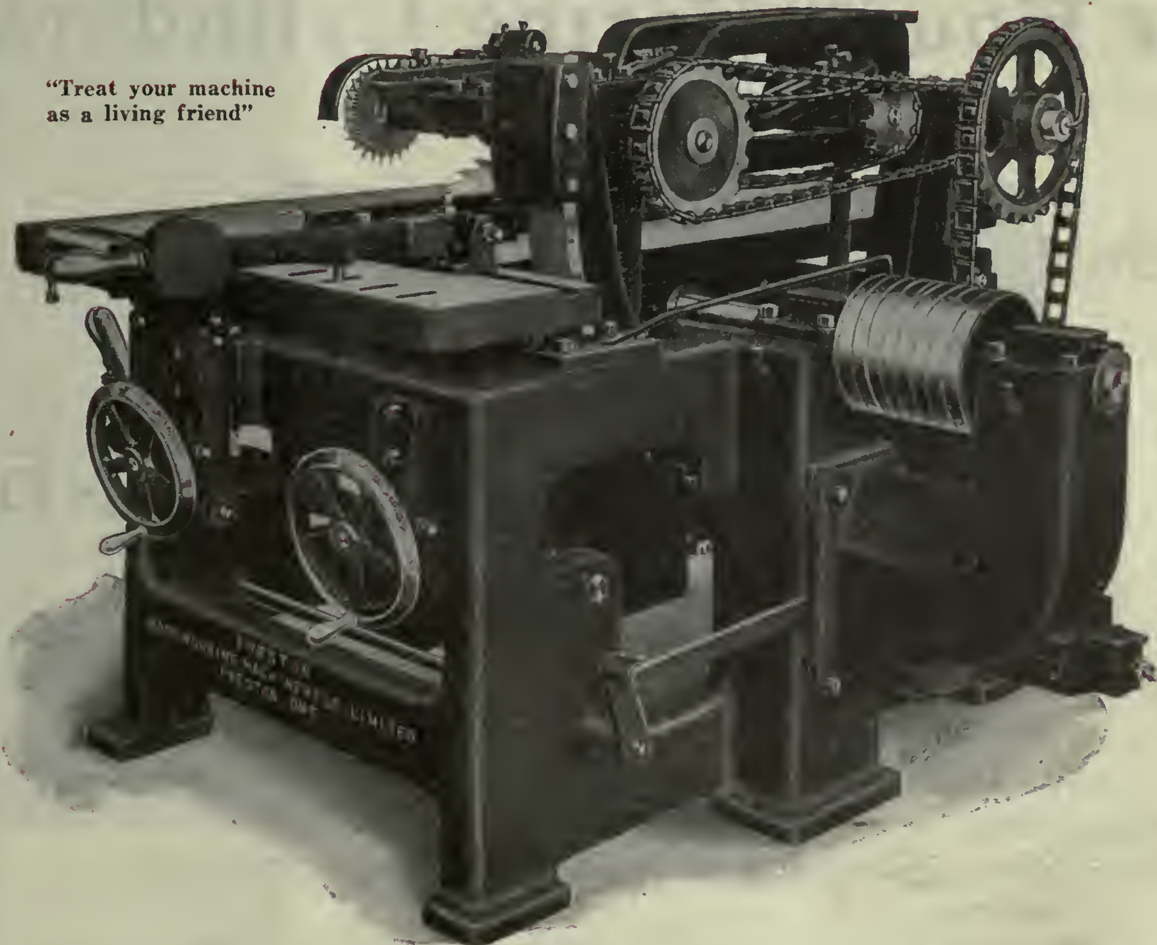

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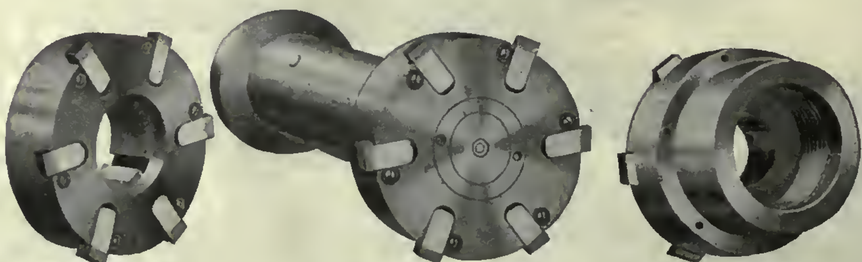

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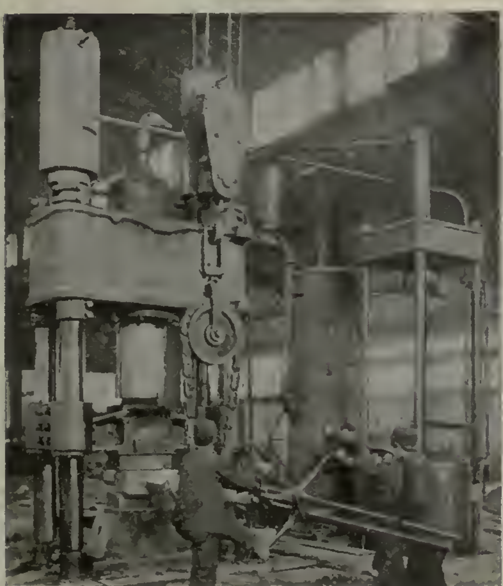

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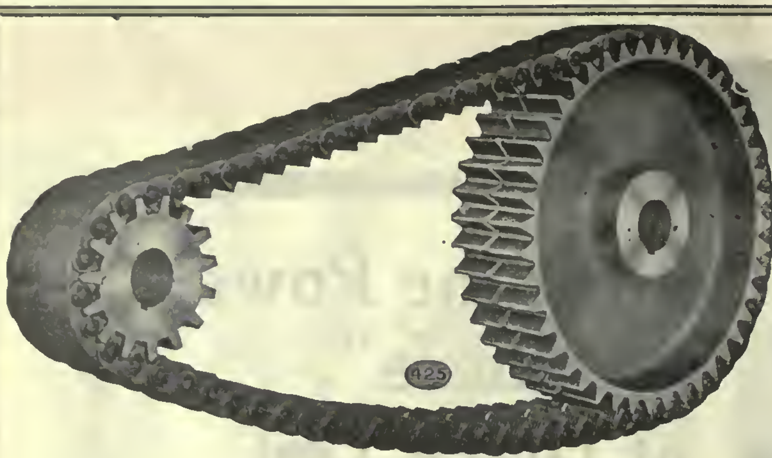

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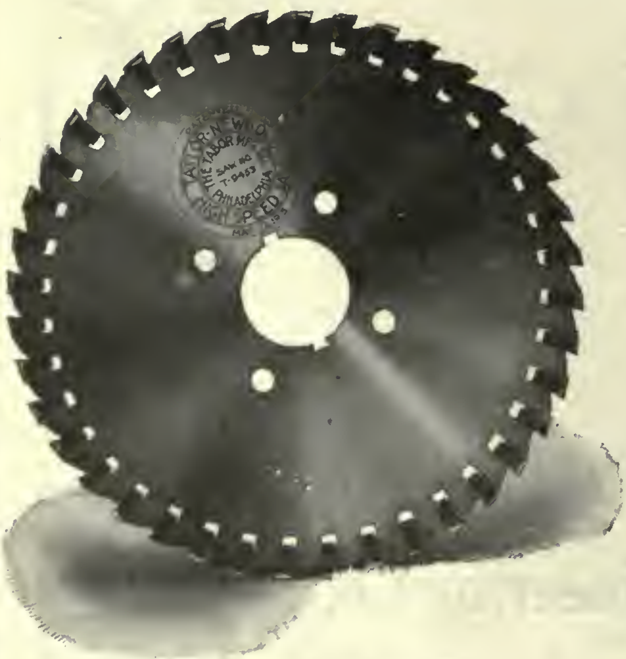

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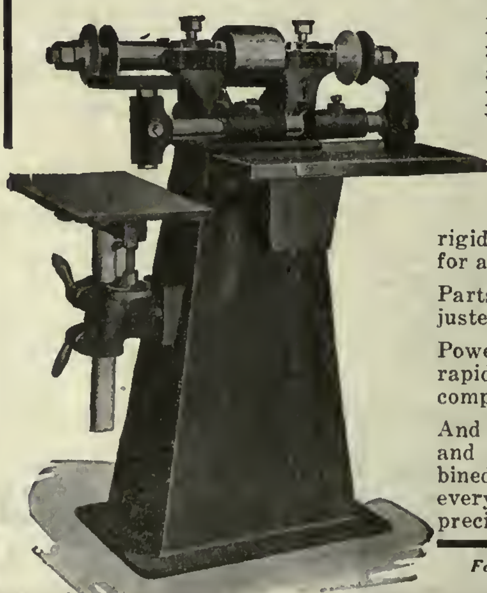

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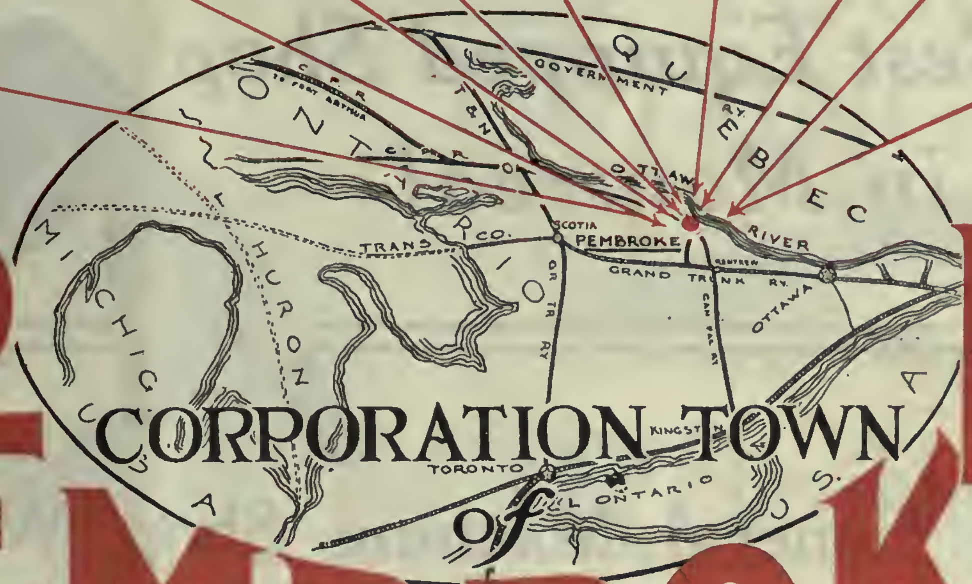

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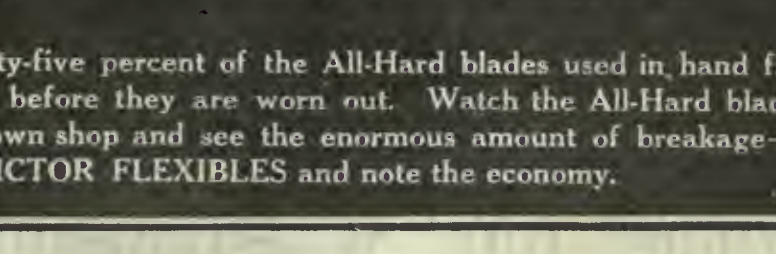

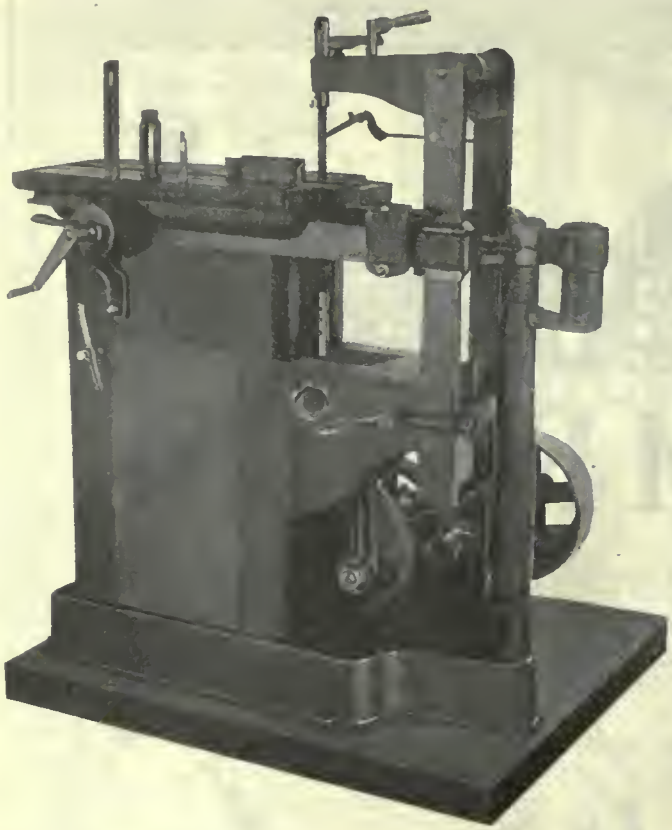

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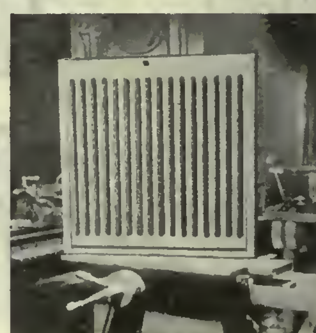

Slots cut in Tool Posts.

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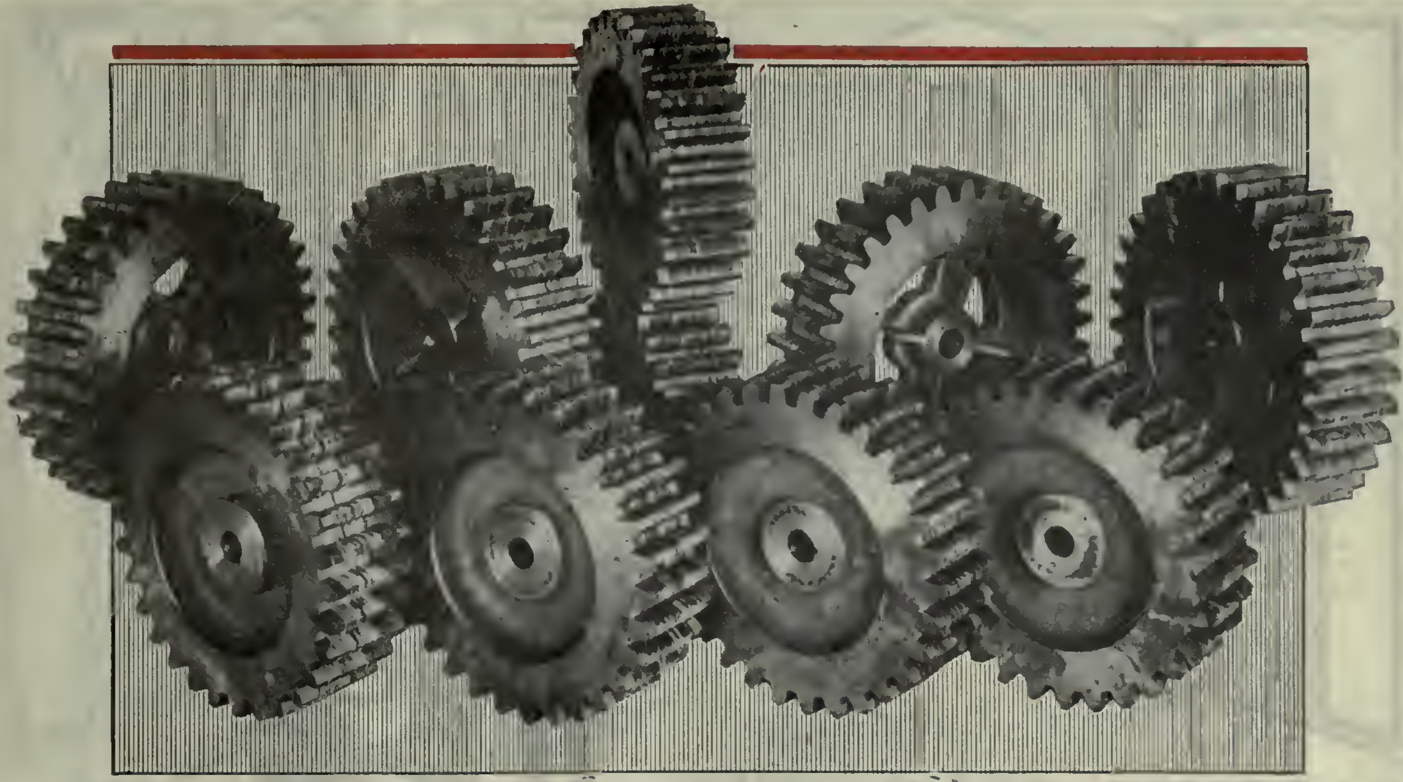

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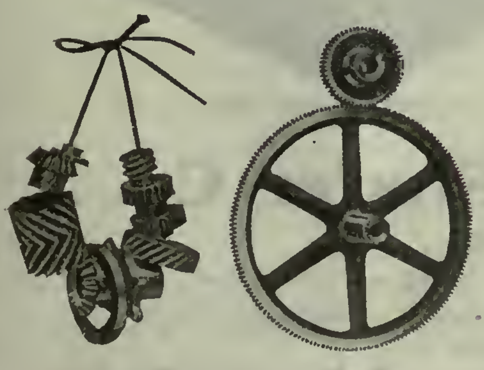

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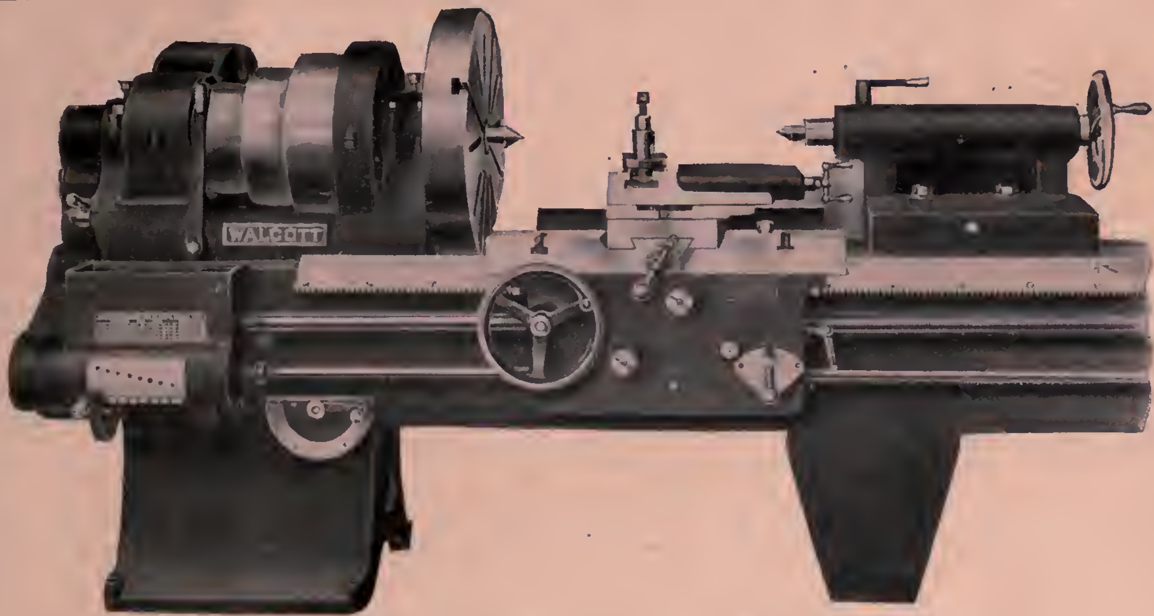

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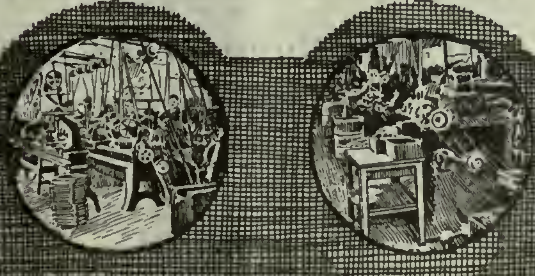

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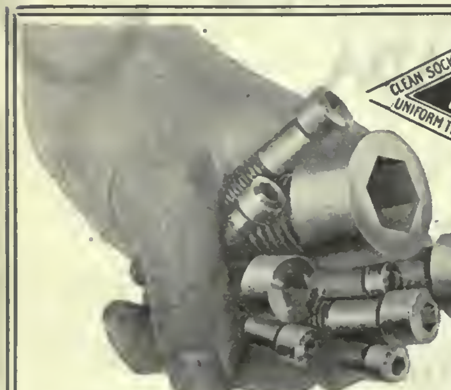

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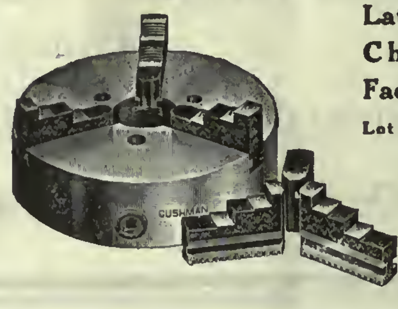

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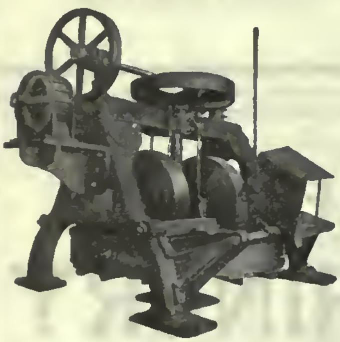

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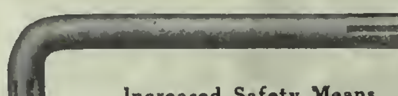

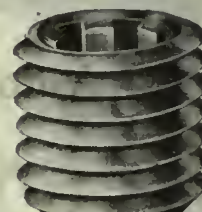

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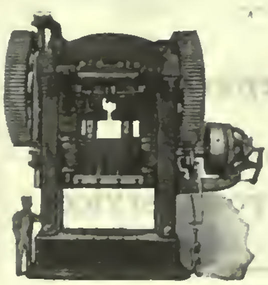

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Do you want help or have you something to sell, if so use the classified column in this paper.

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Directors: G. H. SCHONFIELD, PERCY S. ABRAHAMS

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An old established firm with commanding offices and extensive warehouse, situated in the heart of the City of London, and having sound connections all over Great Britain and Ireland, and the British Colonies, desire to

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Hot Saws, Friction Discs, Solid Blades made of Vanadium, Tungsten and Chrome Alloy Steels. Saw Sharpening Machines, Inserted Tooth Grinders. Hardened Steel Specialties. Write for catalog.

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A universal grinder. A grinder with all attachments. A grinder that will handle all kinds of tool-sharpening as well as cylindrical, internal and surface grinding. An all-around machine for your tool-room.

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SAVE MONEY! Have your broken machine parts made good as new by our Oxy-Acetylene Welding Process. We have the largest plant in Western Canada. Quick service—moderate prices.

MANITOBA WELDING & MANUFACTURING CO.
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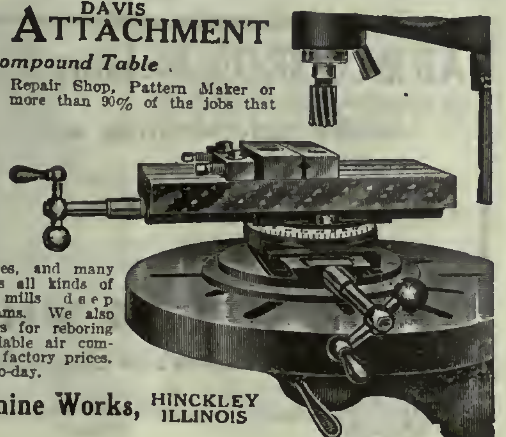
and Compound Table.

For the Die Maker, Repair Shop, Pattern Maker or Garage; will perform more than 90% of the jobs that come up.



For any Drill Press 14" to 42" swing. Big Economy — Big Convenience— Small Price. It relieves your large millers, comes in handy spotting castings, milling ends of bosses, and many other odd jobs. Cuts all kinds of keyseats perfectly; mills deep grooves, slots and cams. We also make cylinder reamers for reboring Ford car, and a reliable air compressor—all at special factory prices. Write for circulars to-day.

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ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.

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Combined Jaw and Friction. Friction only.
Gas Engine Clutches. Jaw Clutches.

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We Manufacture	Masks and Helmets
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You have often thought that some friend or acquaintance would be interested in articles which you have read in CANADIAN MACHINERY. Obey the impulse to pass a good thing along.

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Taper Pins

Not my pay envelope, but I am always pleased when Canadian workmen produce a high class product by the use of which I can increase my production and efficiency, for that is what increases the amount in my envelope and at the same time enables the boss to sell more and better machinery.

In our plant we have used GALT TAPER PINS for over a year and want no other as a substitute. We have proved that these pins are stronger, a true turned taper, and being made of high carbon bessemer stock will not readily sheer off. Try a sample in your next order. You will be as pleased as I am.

Accurate screws and nuts in stock for prompt shipment.

The Galt Machine Screw Company, Limited

GALT, ONTARIO, CANADA

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Machine Tools

Fig. 6

Fig. 6. No. 190 "Wells" Universal Tool and Cutter Grinder. Redesigned—will keep your tools and cutters in the pink of condition.

Send for
Machine Tool Catalog No. 39-C

Machine Tool Division

Greenfield Tap and Die Corporation

Greenfield, Massachusetts

Canadian Sales Agents:

Wells Brothers Company of Canada, *LIMITED*

GALT, ONTARIO


Precision in Threading
GTD
Precision in threading can be attained only by the use of precision tools.
The "Gun" Tap
The "Gun" Tap holds all records for accuracy, speed and durability. Its shearing cut requires a minimum of driving power and is self-cleaning—it shoots the chips ahead.
The "Gun" Tap maintains its size and lead in any material.
The Acorn Die
The Acorn Die is capable of a minute adjustment, holds its lead with accuracy, is absolutely rigid while cutting and will outwear a number of ordinary dies.
Nicely illustrated booklets describing the "Gun" Tap and the Acorn Die will be sent on request. Also new No. 40 Small Tools Catalog.
Wells Brothers Company
of Canada, Limited
GALT, ONTARIO
Canadian factory of the
Greenfield Tap and Die Corporation
GTD
GTD
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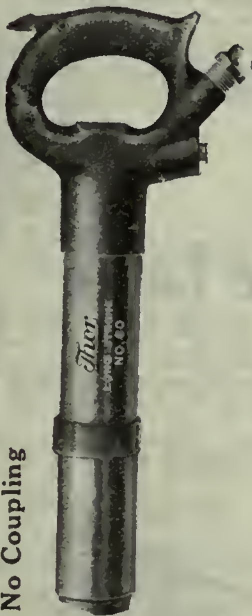
Thor PNEUMATIC TOOLS
MAKE EFFICIENCY A HABIT



No Coupling

No. 60 Long-Stroke Riveting Hammer

The wonderful records of the shipbuilders and war industries have been made possible by the use of pneumatic tools.

Thor Pneumatic Tools are indispensable where large production and speed are necessary.

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Time Saving Tools

No. 60 One-Piece Long Stroke Hammer driving ⅞-inch flush rivets in Engine Room Bulkheads.

Pistol Grip Chipping Hammer with Single Valve. No Vibration. Five Sizes. 1 to 5" Stroke

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No. 40—Bench Rammer

Independent Pneumatic Tool Company

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The Wickes 26" Heavy Duty Quick Change Gear Lathe

Wickes Brothers

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Radial Wall Drills

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Wickes
Heavy Duty Engine Lathe

Double Back Geared Three-Step Cone. Double Plate Apron. Liberal size of parts, and high grade workmanship make the Wickes Lathe equal to the most severe service.

The Wickes has Special Ball Thrust Bearings; Steel Apron Gears, Coarse Pitch and Wide Face Gears, which are all well guarded. Let us tell you ALL about our lathes. Built for real service from 17" to 48" swing.

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We can make prompt shipments. Made for rigid attachment to column or wall, or with bracket for vertical adjustment. Motor-driven. Operating lever has two points of leverage, one for light and one for heavy work, the one giving 10" and the other 5" movement to the spindle.

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Spindles have bronze bearings and ball bearing thrust collars. Built in two sizes, with arm 8' to 18'. Write for full details to-day. We are in position to make prompt shipments.

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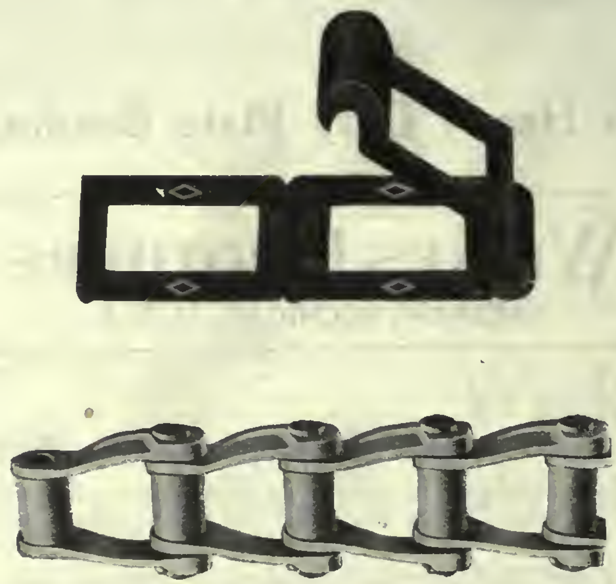

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We like to think of that.

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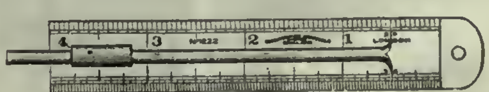
Chesterman tools are the highest standard of accuracy in the British Empire, and the quality of steel and substantial build guarantee a maximum of service and economy.



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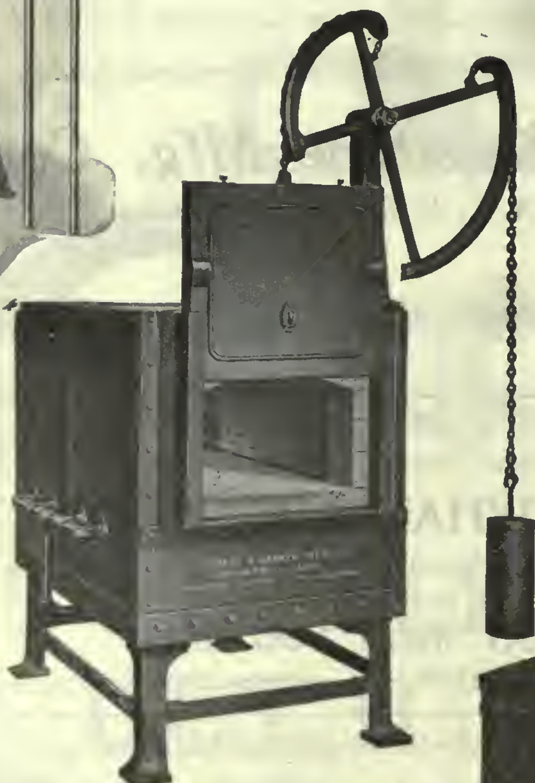
For Immediate Deliveries

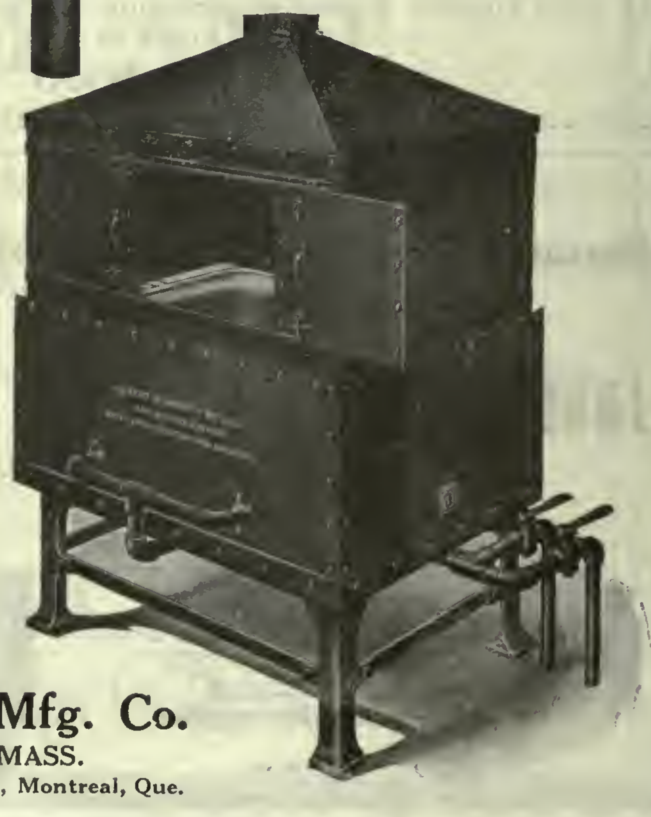


WHEN you require a heat treating furnace delivered to you promptly specify G. & B. in your order. Extensive manufacturing facilities enable us to keep ahead of the demand and you can secure certain standard types of furnaces for hardening and tempering directly from our stock.

G. & B. Furnaces Assure You 100% Efficiency In Heat Treating

The "C" type—especially designed for hardening taps, dies, milling cutters, etc., may be had in two sizes; one has a heating chamber 24 x 36 x 12 in. and the other 25 x 58 x 12 in.

The "K" type meets every requirement in the heat treating of high speed steels. Despite the fact that temperatures up to 2,600 deg. Fahr. may be obtained and maintained uniformly — this furnace rates very low on fuel consumption.



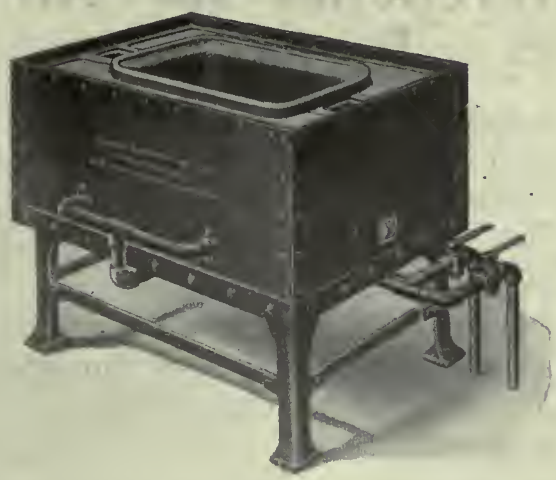
Enquiries Promptly Answered

Gilbert & Barker Mfg. Co.
WEST SPRINGFIELD, MASS.
Canadian Agents: Williams & Wilson, Montreal, Que.

Gilbert & Barker Furnaces

For All Heat Treating Purposes

THE G. & B. Furnaces you see illustrated here represent our smaller types which we are prepared to ship from stock on receipt of your order. There's a G. & B. Furnace for every heat-treating purpose. Standard designs cover all ordinary requirements and when you require a special furnace for special purposes we are prepared to suit your need precisely.



Advice on All Heat Treating Problems

For 50 years we have specialized in the manufacture of furnaces and our experience may be of service to you. We recommend the type of furnace that will fulfill your conditions most efficiently.

G. & B. Type "E" Furnaces have been recognized leaders in the heat treatment of steel in cyanide of potassium. Such fine work as dies with finely engraved working surfaces are handled with perfect ease in this furnace. It may be had in several usable sizes.

Then there is the Type "F" Lead Hardening Furnace adapted for work that cannot, because of its shape or size, be handled easily in a round pot. This type, as well as Type "E" may be supplied with or without a hood.

G. & B. Furnaces may be supplied for gas or oil fuel as desired—or if combination is desired we will fit with the G. & B. Combination Gas Oil Burner.

G. & B. Furnaces always produce just the correct heat, the oil or gas valve makes them extremely easy to operate—no ash to handle—no drafts to watch—just 100% efficient heat treating with the least amount of attention.

G. & B. Heat Treating Furnaces can save you money and it will pay you to get in touch with us.

Write for Prices and Catalog of G. & B. Furnaces

Gilbert & Barker Mfg. Co.

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W & B CO

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A quality of steel that will stand severe strains and wear extra well is represented in **W. & B.** Wrenches. They reflect best workmanship, too.

These tools are to be found in extensive use in every quarter of the world. They have won their way through good service, extending over a period of 62 years.

There's a W. & B. Wrench for every purpose.

MACHINISTS' KNIFE HANDLE WRENCH

PIPE WRENCH

AUTO WRENCH

Every Article Guaranteed

ADJUSTABLE "S" WRENCH

THE WHITMAN & BARNES MFG. CO.

ESTABLISHED 1854

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Out in Three Minutes

The Walton in Operation

How long does it take you to extract a Broken Tap? More than three minutes? If it takes you longer valuable time is going to waste. What you require is the

WALTON TAP EXTRACTOR

Three minutes is average time this handy little device takes to back out a broken tap.

The WALTON is quick and simple. The strong, steel fingers slip into the flutes, grip the broken tap and away it comes.

If you have not got a Walton Tap Extractor handy you are causing yourself a lot of unnecessary trouble.

You can have a Walton Tap Extractor for 60 days' free trial. Anyway write for further information, it will pay you.

THE WALTON COMPANY

HARTFORD, CONN.

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By Using Parts Made in the Punch Press

Look over your standard parts, Mr. Manufacturer, and see what parts can be made (or could be made by slight change in design) by this process.

You will be surprised at the saving you can effect.

We make Blanking, Perforating, Drawing, Forming and all classes of dies and tools for plain or difficult stamping to suit the production required.

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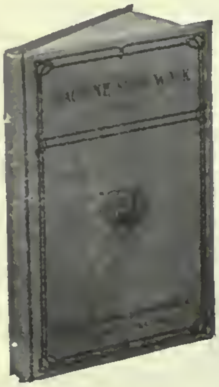
If you are desirous of improving yourself in your trade and so putting yourself in the position of making more money, these Mechanical Engineering Books will be found helpful.



MACHINE-SHOP WORK. By Frederick W. Turner, Instructor in Machine-Shop Work, Mechanics Arts High School, Boston. 208 pp., 241 illus. Cloth binding. The use of various hand tools is explained, followed by a comprehensive discussion of the lathe and lathe tools, with the methods of screw cutting, taper and eccentric turning, etc. The way to figure compound gears for screw cutting; drilling; boring; planers; shapers; slotters; milling machines and cutters; how to cut spirals, gears, cams, etc.; grinding; the operation of automatic machines. Price $1.50

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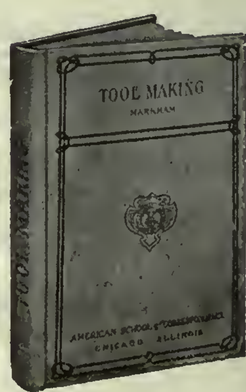

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They are now equipped to handle everything in Oxy-Acetylene, Electrical and Thermit work. No job too small, and none too large.

OXY-ACETYLENE WELDING DAVIS APPARATUS DAVIS-BOURNONVILLE CO. N.Y.

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Portable Generators	Hose	Carbon Removers
Stationary Generators	Carbide	Portable Trucks
Welding Torches	Welding Rods	Compressed Acetylene
Cutting Torches	Flux	Electrolytic Oxygen
Regulators	Carbonite Rods	99.80% pure
	Goggles	

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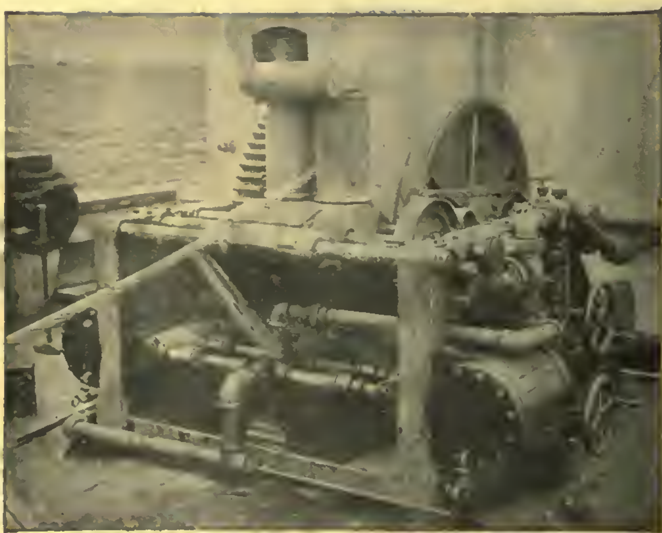
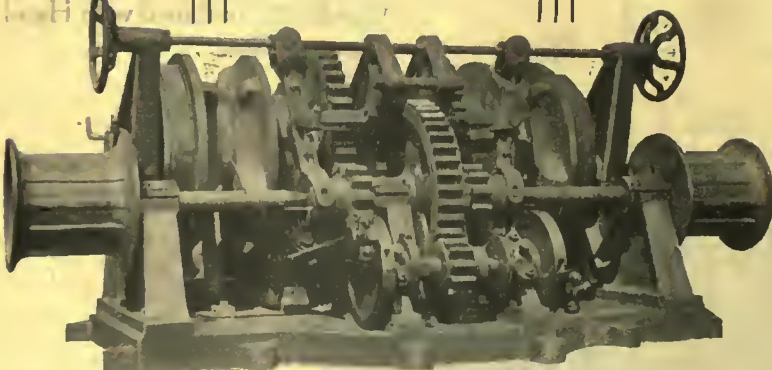
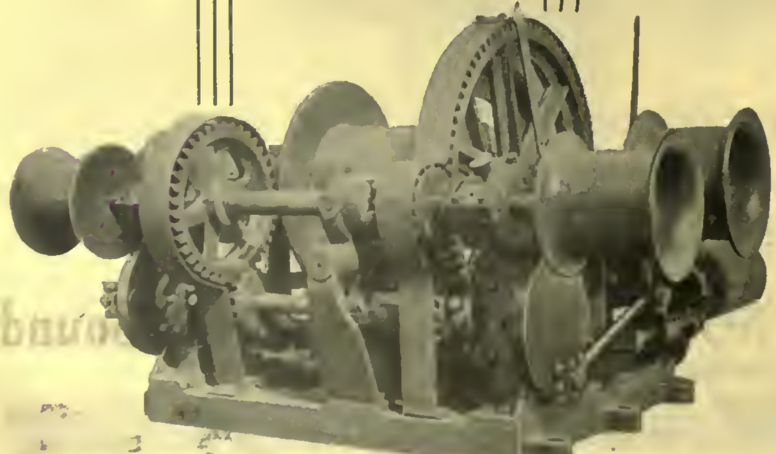
Hyde Engineering Works



The "Corbet" Automatic Steam Towing Machine
For Tugs and Barges



The "Corbet" Double Cylinder and Double Purchase Steam and Hand Power Anchor Windlass



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Line of

Marine Machinery

THE CORBET AUTOMATIC STEAM TOWING MACHINES are made in five sizes to accommodate Steel Flexible Hawsers from 5/8 in diameter up to 2″ in diameter.

The Most Modern Towing Machine on the Market Saves its Cost in Three Seasons

These machines are in active operation on tugs and steamers on the Atlantic and Pacific coast, and also on the Great Lakes. They are giving perfect satisfaction, as the numbers of testimonials from our customers will prove. Write for copies of testimonials and for full information.

THE CORBET DOUBLE CYLINDER AND DOUBLE PURCHASE STEAM AND HAND-POWER ANCHOR WINDLASSES are made in several sizes to accommodate Steel Chain Cable up to 1 13/16 in. diameter. Reversible throttle. Modern in every respect.

Our Cargo Winch is modern in every respect, being built to pass Government Inspection, and is giving perfect satisfaction.

Delivery When Promised—Satisfaction Guaranteed.

Write for prices and delivery in size required.

The Corbet Foundry and Machine Company, Limited
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Long & Allstatter Shears
in the plant of
Dominion Steel Foundry Company
Limited
HAMILTON
ONTARIO

Punching, Shearing and Forging Machines

and Machinery Equipment for Shipyards, Steel Car Plants, Rolling Mills, Bridge and Structural Works.

Send for our new 304-page catalog.

It illustrates and describes 267 machines, including Power Punches—Single—Double—Vertical and Horizontal, also Multiple Punches, for any number of holes. Power Shears for Bars—Plates—Beams—Angles—Channels and Special Shapes, also Angle Shears—Splitting Shears and Alligator Shears. It also shows Bending and Forming Machines—Riveting and Punching Machines and Special Machinery for Special Work.

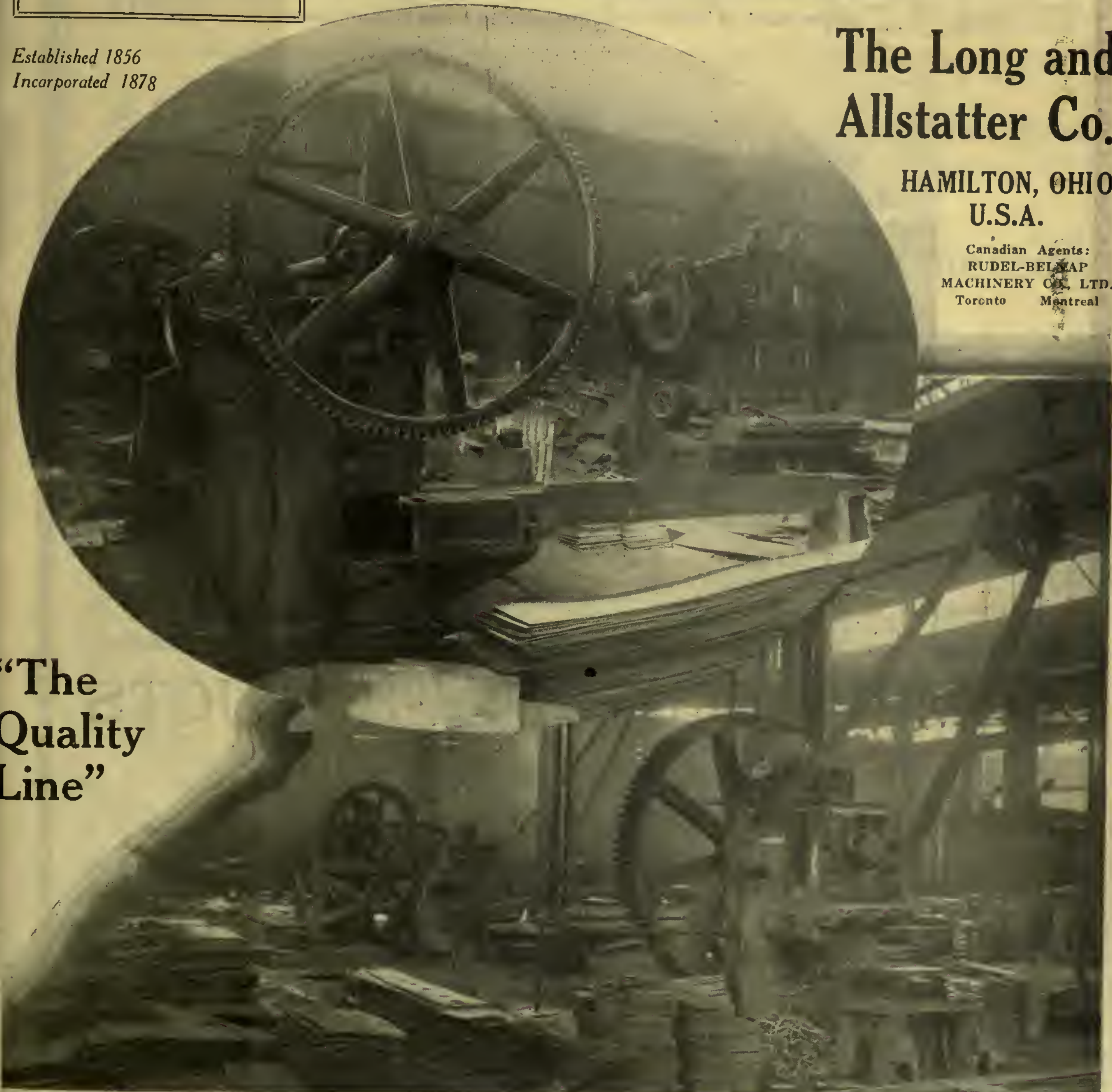
All machines are built of the same high-grade workmanship and material that have given the "L. & A." product a recognized standard of quality of over 50 years.

Established 1856
Incorporated 1878

The Long and Allstatter Co.

HAMILTON, OHIO
U.S.A.

Canadian Agents:
RUDEL-BELNAP MACHINERY CO., LTD.
Toronto Montreal



"The Quality Line"

External Limit Gauge.
Style 31

External Limit Gauge. Style 30

Adjustable External Limit Gauge.
Style 32

Why Not Use Taft-Peirce Tool Room Specialties

NO BOTHER, NO DELAY AND NO UNCERTAINTY

As to character and quality, Taft-Peirce tool-room specialties have been standardized. They are manufactured in quantities, cost less than those made in your own tool-room, and the line is complete enough to meet most requirements.

Ask your dealer, or write for catalogue 104E.

TAFT-PEIRCE
Woonsocket, R.I., U.S.A.

Williams & Wilson Limited
Montreal and Quebec
Detroit, Majestic Building

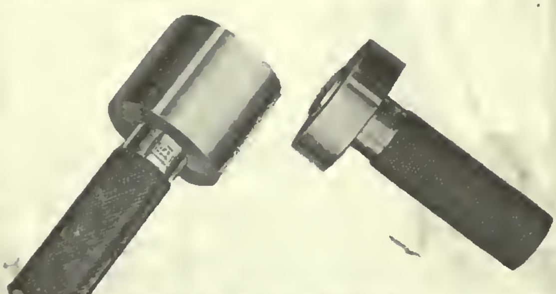
Martell Adjustable Hand Reamer

The most accurate and quickly adjusted hand reamer—one pair blades at right-hand angle and two pairs at left-hand angle to the center line—

Eliminates Chatter and Cuts

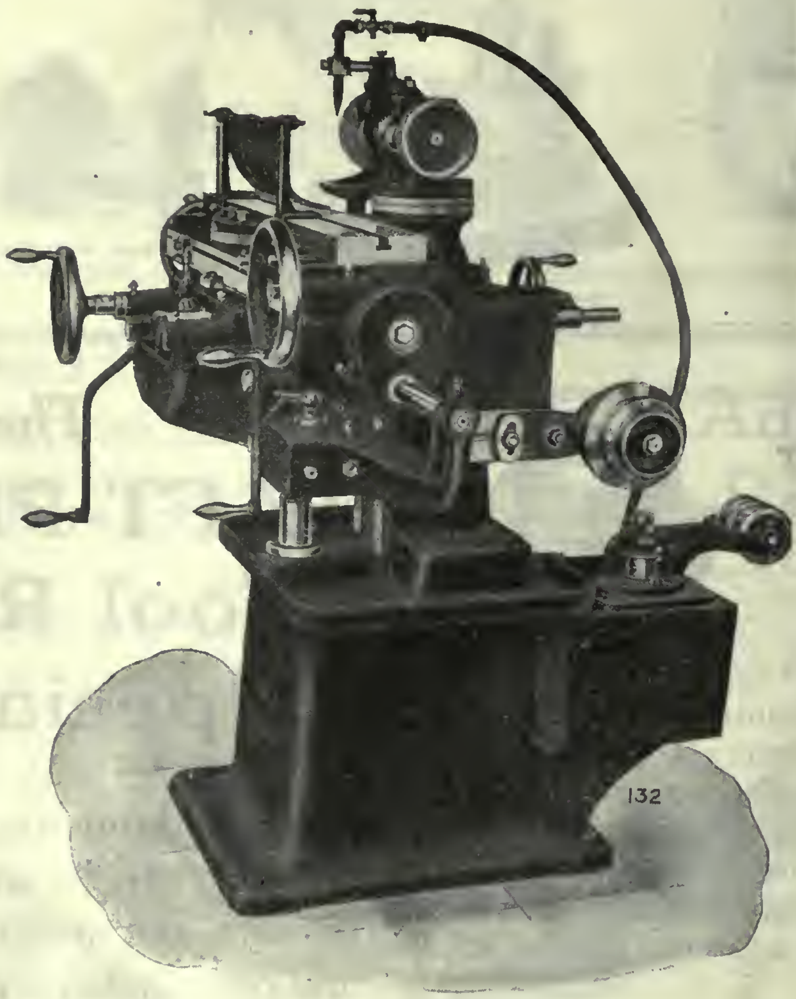
A More Nearly Perfect Round Hole

Cross-section of Adjustable Hand Reamer (Style 720). Note that three wedges are used under each blade instead of two. The reamer blade is finished so that it balances on the middle wedge and can only be seated on the end wedges by drawing up the clamping nut firmly. The blades are ground in this position so that when the pressure is released as when taking them out, they are actually concave instead of straight. By clamping the blades in this strained position they are held firmly throughout their entire length and the cutting edge held perfectly straight.



Individual Limit Plug Gauges.
Style 16-18

Limit Plug Gauges. Styles 11, 12 and handle 1.



No. 2 Oakley Universal and Tool Grinder

With Longitudinal Power Feed and Wet Grinding Attachment

Three Table Speeds	6"	per min.
	10½"	"
	18"	"

The stop dogs are hinged so that the operator may run the work past the setting to measure both external and internal work.

The machine can be operated by hand by disengaging the clutch.

Furnished with plain or universal equipment.

This machine is exceptionally

Heavy, Rigid and Accurate

Range—	
Longitudinal movement	17"
Vertical movement	10½"
Cross movement	9"
Work Centers—	
Maximum swing over table	10"
Maximum length	20"
Will swing a cutter at right angles	16"

This machine, within its range, will sharpen rapidly and accurately any style or shape of milling cutter, and when furnished as a universal machine, equipped with attachments for gear cutter, cylindrical internal and surface grinding, it will grind all work that comes to the tool room.

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	Dia.		Stroke
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No. 1½ GEAR MILLER..........	4"	16 P.	2"
No. 2 GEAR MILLER..............	6"	14 P.	3½"
No. 2½ GEAR MILLER..........	6"	10 P.	3½"
No. 3½ GEAR MILLER..........	8"	8 P.	5½"

The moderate cost of these machines makes them a desirable investment. Since they can be used for varied classes of work, the first cost can be realized within a comparatively short period.

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Full automatic action; positive and direct indexing to the work; cutter clears work while indexing takes place; quick releasing fixtures for removing work; high production through quick action of machine; automatic stop of feed when work is done; easily controlled; operator can run other machines.

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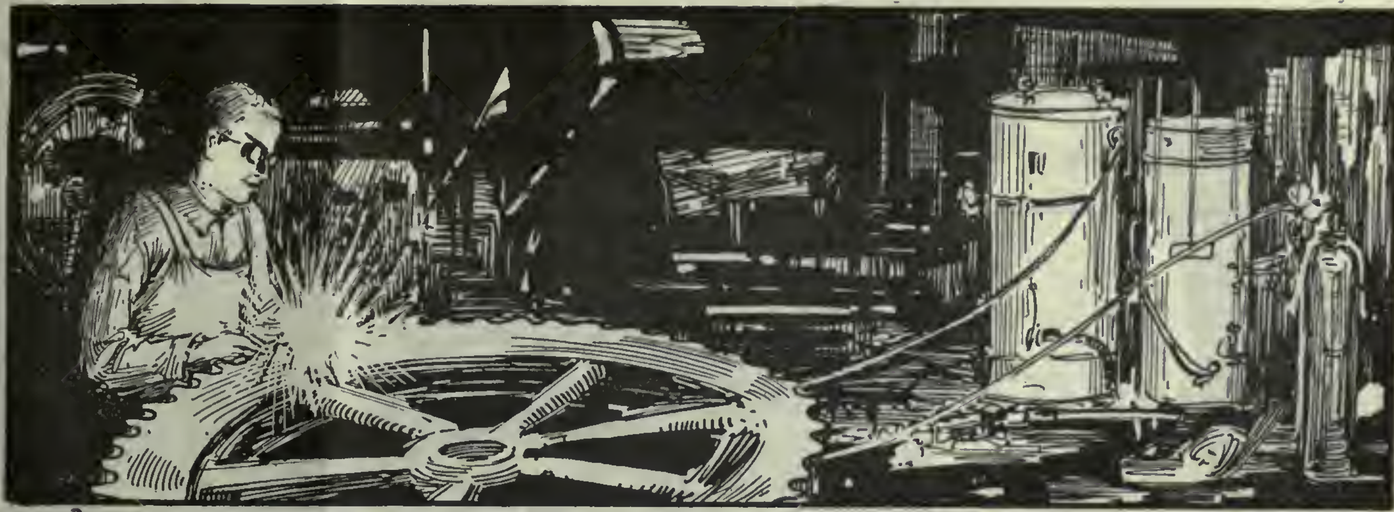

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Cushman Chuck Co., Hartford, Conn.
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin, Brantford
Knight Metal Products, Ltd., Toronto, Ont.
Manufacturers Equipment Co., Chicago, Ill.
Modern Tool Co., Erie, Pa.
Rice, Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Canada.
Whitney Mfg. Co., Hartford, Conn.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

CHUCKS, MAGNETIC
D. & W. Fuse Co., Providence, R.I.
F. Pratt & Co., Halifax.
Heald Machine Co., Worcester, Mass.

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
F. Pratt & Co., Halifax.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WRENCH
F. Pratt & Co., Halifax.
Thomas Elevator Co., Chicago, Ill.

CHUCKS, SPLIT
Rivett Lathe & Grinder Co., Boston, Mass.

CHUCKS, DRILLS AND TAPS
Bicknell-Thomas Co., Greenfield, Mass.

CHUCKING MACHINES
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
New Britain Machine Co., New Britain, Conn.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach Co., Brazil, Ind., U.S.A.

CLAMPS
Preston Woodworking Machine Co., Preston, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLEANERS, BOILER TUBE
Goldie & McCulloch Co., Galt, Ont.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLUTCHES, CHAIN
Jones & Glassco, Montreal, Que.

CLUTCHES
Goldie & McCulloch Co., Galt, Ont.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Jones & Glassco., Montreal, Que.
Positive Clutch & Pulley Works, Ltd., Toronto.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Marsh Engineering Works, Ltd., Belleville, Ont.
MacIntyre & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto, Ont.
Sleeper & Hartley, Inc., Worcester, Mass.

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.
Nova Scotia Steel & Coal Co., New Glasgow, N.S

COLLARS, SHAFTING
Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Limited, Galt, Ont.
J. C. Wilson & Co., Belleville, Ont.

COLLETS
Becker Milling Machine Co., Boston, Mass.
Manufacturers' Equipment Co., Chicago, Ill.
Rivett Lathe & Grinder Co., Boston, Mass.
Wilson & Co., J. C., Belleville, Ont.

COMPOSITION INGOT
Brown's Copper & Brass Rolling Mills, New Toronto.
Canada Metal Co., Toronto, Ont.
United Brass & Lead Ltd., Toronto.

COMBINED OPEN SIDE PLANER-SHAPER
Lynd-Farquhar Co., Boston, Mass.

COMPRESSORS, AIR
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Garlock-Walker Machinery Co., Toronto, Ont.
Hinckley Machine Co., Hinckley, Ill.
MacGovern & Co., Montreal, Que.
Riverside Machinery Depot, Detroit, Mich.
Smart-Turner Machine Co., Hamilton, Ont.

CONCRETE MACHINERY
St. Clair Bros., Galt, Ont.

CONDENSERS
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.

CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland, Ont

CONTRACT WORK
Banfield, W. H., & Sons, Toronto.
Brown Engineering Corp., Toronto.
Homer & Wilson, Hamilton, Ont.
Katie Foundry Co., Galt, Ont.
Marten Machine Co., Hamilton, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.
Wilson & Co., J. C., Belleville, Ont.
Welland Motor & Machine Co., Welland, Ont.
Windsor Mach. Tool Co., Windsor, Ont.

CONTROLLERS AND STARTERS
Williams Machy. Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.

CONVERTERS, STEEL SLIDE-BLOW
Whiting Foundry Equipment Co, Harvey, Ill.

CONVEYING MACHINERY
Brown Portable Conveying Mach. Co., Chicago.

CONVEYORS, BELT AND CHAIN
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

COPING MACHINES
Can. Blower & Forge Co., Kitchener, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York.

COPPER, BUS BAR, SHEET, PLATES, RODS
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice, Lewis & Son, Toronto, Ont.

COUNTERSHAFTS
Almond Mfg. Co., T. R., Ashburnham, Mass.
Baird Machine Co., Bridgeport, Conn.
Foster Machine Co., Elkhart, Ind.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.

COUPLINGS, SHAFT
Goldie & McCulloch Co., Galt, Ont.
W. H. Nicholson & Co., Wilkesbarre, Pa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co. of Canada, Toronto
Gardner, Robt., & Son, Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.
Wilson & Co., J. C., Belleville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

CRANES, GANTRY
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES
Pollard Mfg. Co., Niagara Falls, Can.

CRANES, JIB
Pollard Mfg. Co., Niagara Falls, Can.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Wilson & Co., J. C., Belleville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Anderson & Co. of Canada, Geo., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.

CRANK SHAFTS
Canada Found's & Forgings, Ltd., Welland, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

Northern Crane Works, Walkerville.
Rice, Lewis & Son, Toronto, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.
J. C. Wilson & Co., Belleville, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUCIBLES
Hyde Engineering Co., Montreal, Que.

CRUSHED STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

CUPOLA BLOCKS
Hyde Engineering Co., Montreal, Que.

CUPOLAS
Can. Blower & Forge Co., Kitchener, Ont.
Northern Crane Works, Walkerville.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

CUPOLA BLAST GAUGES AND BLOWERS
Sheldons, Ltd., Galt, Ont.

CURRENT TRANSFORMERS
Electric Steel & Metals, Ltd., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Zenith Steel & Coal Products, Montreal, Que.
J. C. Wilson & Co., Belleville, Ont.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co. of Canada, Toronto.

CUTTERS, PIPE (SEE PIPE CUTTERS)

CUTTERS, MILLING
Becker Milling Machine Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Machine Co. New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Rice, Lewis & Son, Toronto Ont.
Tabor Mfg. Co. Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Elm Cutting Oil Co., Toronto.
Ontario Lubricating Co., Hamilton, Ont.

CUTTING-OFF MACHINES
Armstrong Bros. Tool Co., Chicago.
Bertram & Sons Co., John, Dundas.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Hurlburt, Rogers Machy Co., South Sudbury, Mass
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Peerless Machine Co., Racine, Wis.
Prest-O-Lite Co., Inc., Toronto, Ont.
Racine Tool & Machine Co., Racine, Wis.
Standard Mchy & Supplies, Ltd., Montreal, Que.
Tabor Mfg. Co. Philadelphia, Pa.
Yates Machine Co., P. B., Hamilton, Ont.

CUTTING AND WELDING PLANTS
Canadian Welding Works, Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies, Ltd., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor, Ont.

CYLINDERS, AIR
Manufacturers Equipment Co., Chicago, Ill.
Smalley General Co., Inc., Bay City, Mich.

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Hinckley Machine Co. Hinckley, Ill.
Kelley Reamer Co., Cleveland, O.

DEEP DRAWING DIE STEEL
J. F. A. Comstedt, New York City, N.Y.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
M. Beatty & Sons, Ltd., Welland, Ont.
Dominion Bridge Co. Montreal.
Marsh Engineering Works, Belleville, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DERRICK IRONS AND FITTINGS
Pollard Mfg. Co., Niagara Falls, Can.

DIAMOND TOOLS
Wheel Trueing Tool Co., Windsor, Ont.
Anderson & Co. of Can., Geo., Montreal, Que.
Wheel Trueing Tool Co., Detroit.

DIAMONDS, CARBON & BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DISCS, LATHES, ETC.
Leather Products of Canada, Hamilton, Ont

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pittsburgh Steel Stamp Co., Pittsburgh, Pa.

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Banfield, W. H., & Son, Toronto.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Canadian Fairbanks-Morse Co., Montreal.
The Geo. F. Foss Mchy & Supply Co., Montreal.
Gardner, Robt., & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.

Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Standard Mechy. & Supplies, Ltd., Montreal.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.

DIES, NOSING
Marsh Engineering Works, Belleville, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Butterfield & Co., Rock Island, Que.
Landis Machine Co., Waynesboro, Pa.

DIE SINKERS
Becker Milling Machine Co., Boston, Mass.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.

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, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
Wells Brothers Co. of Canada, Galt, Ont.

DIE BLOCKS, HEAVY FORGED
Hammond Steel Co., Inc., Syracuse, N.Y.

DIE FORGINGS
Hammond Steel Co., Inc., Syracuse, N.Y.

DIE STEEL, HOT AND COLD WORK
Armstrong, Whitworth of Canada, Montreal, Que.
Firth & Sons, Thos., Montreal, Que.

DIES FOR SCREW PLATES
Wells Brothers Co. of Canada, Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Illinois Tool Works, Chicago, Ill.
Marten Machine Co., Hamilton, Ont.
Normac Machine Co., St. Catharines, Ont.
Stoll Co., D. H., Buffalo, N.Y.
Windsor Mach. & Tool Co., Windsor, Ont.
Worth Engineering Co., Toronto, Ont.

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, Mich.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Ltd., Montreal.

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.

DREDGES, DIPPER, HYDRAULIC AND CLAMSHELL
M. Beatty & Sons, Ltd., Welland, Ont.

DRESSERS, GRINDING AND EMERY WHEEL
Baxter & Co., Ltd., J. R., Montreal, Que.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Ford-Smith Mach Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
W. F. & John Barnes Co., Rockford.
Barke Machine Tool Co., Conneaut, O.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp, Galt, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Riverside Machinery Depot, Detroit, Mich.
Stow Mfg. Co., Binghampton, N.Y.
United States Mech. Tool Co., Cincinnati, O.
A. R. Williams Machinery Co., Toronto.

DRILL CHUCKS, QUICK-CHANGE
The McCrosky Reamer Co., Meadville, Pa.

DRILL RODS
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLS
W. T. Whitehead, Son & Co., Montreal, Que.

DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Bilton Mach. Tool Co., Bridgeport, Conn.
Canada Machinery Corp., Galt, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Henry & Wright Mfg. Co., Hartford, Conn.
A. B. Jardine & Co., Hespeler, Ont.

Landis Tool Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach. Co., Rockford, Ill.
W. T. Whitehead, Son & Co., Montreal, Que.

DRILLING MACHINES
Universal Boring Mach. Co., Hudson, Mass.

DRILLING MACHINES RADIAL AND TURRETT
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Reed-Prentice Co., Worcester, Mass.

DRILLING MACHINES, SENSITIVE
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
D. McKenzie Machinery Co., Guelph, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati, Ohio

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Machinery Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Giddings & Lewis Mfg. Co., Fond du Lac, Wis.
Fry's (London), Ltd., London, England.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Reed-Prentice Co., Worcester, Mass.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach. Co., Rockford, Ill.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, BALL BEARING
Cincinnati Pulley Mach. Co., Cincinnati.

DRILLING MACHINES, VERTICAL
Giddings & Lewis Mfg. Co., Fond du Lac, Wis.

DRILLING MACHINES, WALL RADIAL
Lynd-Farquhar Co., Boston, Mass.
Wickes Bros., Saginaw, Mich.

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, Ont.
W. F. & John Barnes Co., Rockford, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Fry's (London), Ltd., London, England.
Garlock-Walker Machinery Co., Toronto, Ont.
Millers Falls Co., Millers Falls, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
United States Electrical Tool Co., Cincinnati.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Cleveland Twist Drill Co., Cleveland.
The Geo. F. Foss Mchy. & Supply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Canada, Walkerville, Ont.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Canada, Walkerville, Ont.

DRILLS, ELECTRIC AND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Boker & Co., Inc., H., Montreal, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
United States Electrical Tool Co., Cincinnati.
A. R. Williams Machinery Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.

DRILLS, EMERY
Garlock-Walker Machinery Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong, Whitworth of Canada, Montreal, Que
Atkins & Co., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
H. A. Drury Co., Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal
McKenna Brothers, Pittsburgh, Pa.
Marshall & Co., Geo., Toronto, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill.
Perfect Machine Co., Galt, Ont.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Taylor, J. A. M., Stair Bldg., Toronto.

Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co of Canada, Walkerville, Ont.
Wilkinson & Kompass, Hamilton, Ont.

DRILLS, OIL TUBE
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

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, Ohio.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Millers Falls Co., Millers Falls, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Perfect Machine Co., Galt, Ont.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Canada, Walkerville, Ont.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
A. R. Williams Machy. Co., Toronto.

DRILLS, TRACK
Cleveland Twist Drill Co., Cleveland.
The Geo. F. Foss Mchy. & Supply Co., Montreal
Morse Twist Drill & Mch. Co., New Bedford, Mass
Wilt Twist Drill Co. of Canada, Walkerville, Ont.
United Brass & Lead, Ltd., Toronto.

DRIVES, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co.
Jones & Glassco, Montreal.
Morse Chain Co., Ithaca, N.Y.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sheldons, Ltd., Galt, Ont.

DRUM CONTROLS
Electric Steel & Metals, Ltd., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Marsh Engineering Works, Belleville, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Pratt & Whitney Co., Dundas, Ont.
MacGovern & Co., Montreal, Que.
Standard Machy. & Supplies, Ltd., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadel., Pa.
Volta Mfg. Co., Welland, Ont.
Electric Steel & Metals, Ltd., Welland, Ont.

ELECTRIC FURNACE REGULATORS AND EQUIPMENT
Volta Mfg. Co., Welland, Ont.

ELECTRIC INDUSTRIAL TRUCKS, TRACTORS AND ENGINES
Automatic Transportation Co., Buffalo, N.Y.

ELEVATOR ENCLOSURES
Canada Wire & Iron Goods Co., Hamilton, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Can. Matthews Gravity Carrier Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto

EMERY AND EMERY WHEELS
Baxter & Co., Ltd., J. B., Montreal, Que.
Foss Mchy. & Supply Co., The Geo. F., Montreal
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Wilkinson & Kompass, Hamilton, Ont.

EMERY WHEEL DRESSINGS
Wheel Truing Tool Co., Windsor, Ont.

ENGINES, GASOLINE
Can. Barker Co., Sault Ste. Marie, Ont.
St. Clair Bros., Galt, Ont.

ENGINE LATHES
Cincinnati Lathe & Tool Co., Cincinnati, O.
Mueller Machine Tool Co., Cincinnati, O.

ENGINES, STEAM, GAS, GASOLINE
Canadian Fairbanks-Morse Co., Montreal.
Gutta Percha & Rubber, Ltd., Toronto, Can.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Riverside Machinery Depot, Detroit, Mich.

ENGINES, HORIZONTAL AND VERTICAL
Goldie & McCulloch Co., Galt, Ont.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Sheldons, Ltd., Galt, Ont.
A. R. Williams Machy. Co., Toronto.

ENGINES, MARINE
Goldie & McCulloch Co., Galt, Ont.

ENGINES, SINGLE COMPOUND AND TRIPLE EXPANSION
Goldie & McCulloch Co., Galt, Ont.

ENGINES
Waterous Engine Works, Brantford, Ont.

ENGINE SHAFTS
Hammond Steel Co., Inc., Syracuse, N.Y.

ENGRAVERS
Pritchard-Andrews Co., Ottawa.

ESCUTCHEON PINS
Parmenter & Bulloch Co., Gananoque, Ont.

ETCHING MACHINES
Brewster Co., Wm., New York, N.Y.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal
Sheldons, Ltd., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Sheldons, Ltd., Galt, Ont.

EXTRUSION DIE STEEL
J. F. A. Comstedt, New York City, N.Y.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EXTRA TOOL STEEL
J. F. A. Comstedt, New York City, N.Y.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.
United Brass & Lead, Ltd., Toronto.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Canada Wire & Iron Goods Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Can. B. K. Morton Co., Toronto, Ont.
Delta File Works, Philadelphia, Pa.
Marshall & Co., Geo., Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Port Hope File Mfg. Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Wilkinson & Kompass, Hamilton, Ont.

FILTERS, OIL
Bowser & Co., Inc., S. F., Toronto, Ont.

FIRE BRICK
Hyde Engineering Co., Montreal, Que.

FIRE CLAY
Hyde Engineering Co., Montreal, Que.

FIRE ESCAPES
Can. Welding Works, Montreal, Que.
Canada Wire & Iron Goods Co., Hamilton, Ont.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

FITTINGS, MALLEABLE AND CAST IRON
Fittings, Ltd., Oshawa, Ont.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal.
Illinois Tool Works, Chicago, Ill.
Marten Machine Co., Hamilton, Ontario.
Toronto Tool Co., Toronto, Ont.

FLASKS, IRON
Katie Foundry Co., Galt, Ont.

FLEXIBLE SHAFT COILING MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

FLANGING CLAMPS
Wickes Bros., Saginaw, Mich.

FLUE CLEANERS
Goldie & McCulloch Co., Galt, Ont.

FLINT SHOT
U.S. Silica Co., Chicago, Ill.

FLOW METERS
Spray Engineering Co., Boston, Mass.

FORGES, HAND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sheldons, Ltd., Galt, Ont.

FORGES, FOR HARD AND SOFT COAL AND COKE
C. C. Bradley & Son, Inc., Syracuse, N.Y.

FORGINGS, STEEL AND IRON
Can. Foundries & Forgings, Ltd., Welland, Ont.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE

FORGING AND WELDING
Victoria Foundry Co., Ottawa.
Can. Billings & Spencer, Ltd., Welland, Ont.
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Erie Foundry Co., Erie, Pa.
Garlock-Walker Machinery Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.

FORGINGS, SPECIAL
Armstrong, Whitworth of Canada, Montreal, Que.
Williams & Co., J. H., Brooklyn, N.Y.

FOUNDRY SUPPLIES
Hyde Engineering Co., Montreal, Que.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FUEL OIL SYSTEMS
Gilbert & Barker Mfg. Co., Springfield, Mass.

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Chicago Flexible Shaft Co., Chicago, Ill.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Mechanical Engineering Co., Three Rivers, Que.
Tate-Jones & Co., Leetsdale, Pa.
Standard Fuel Engr. Co., Detroit, Mich.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, One.
Hughes Electric Heating Co., Toronto, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES, BLAST
Belleview Industrial Furnace Co., Detroit.
Toronto Iron Works, Ltd., Toronto.

FURNACES, BRASS, MALLEABLE
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES FOR BAKING, BLUING, DRYING, ENAMELING, JAPPANING AND LACQUERING
Hiram Walker & Sons Metal Products, Ltd., Walkerville, One.

FURNACES, FORGING
Gilbert & Barker Mfg. Co., Springfield, Mass.
Standard Fuel Engineering Co., Detroit, Mich.
Strong-Carlyle-Hammond, Cleveland, O.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, One.

FURNACES, ELECTRIC
Electric Furnace Construction Co., Philadelphia.
Hughes Electric Heating Co., Toronto, Ont.
Strong-Carlyle-Hammond, Cleveland, O.

FURNACES, HIGH SPEED STEEL, SHELL
Standard Fuel Engineering Co., Detroit, Mich.
Strong-Carlyle-Hammond, Cleveland, O.

FURNACES, LEAD AND SALT
Standard Fuel Engineering Co., Detroit, Mich.
Strong-Carlyle-Hammond, Cleveland, O.

FURNACES, RIVETING
Standard Fuel Engineering Co., Detroit, Mich.

FUSE BOXES, STEEL
Dom. Forge & Stamping Co., Walkerville, Ont.

FUSES AND CUTOUTS, ENCLOSED, ELECTRIC
D. & W. Fuse Co., Providence, R.I.

FUSE AND SERVICE BOXES
D. & W. Fuse Co., Providence, R.I.

GALVANIZING MACHINERY
Erie Foundry Co., Erie, Pa.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.
Leather Products of Canada, Hamilton, Ont.

GAS WASHING EQUIPMENT
Spray Engineering Co., Boston, Mass.

GAUGES, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, FUSE HOLE
Windsor Mach. & Tool Co., Windsor, Ont.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.
Crescent Mach. Co., Ltd., Montreal.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Machine Co., New Bedford.
Normac Machine Co., St. Catharines, Ont.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.
Toronto Tool Works, Toronto, Ont.
United Brass & Lead, Ltd., Toronto.
Wells Brothers Co. of Canada, Galt, Ont.
Worth Engineering Co., Toronto, Ont.

GAUGES, THREAD
Bicknell-Thomas Co., Greenfield, Mass.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal, Que.
Dom. Foundries & Steel, Ltd., Hamilton, Ont.
Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto, Ont.
Hyde Engineering Works, Montreal, Que.
The Smart-Turner Machine Co., Hamilton, Ont.
D. E. Whiton Machine Co., New London, Conn.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEAR-TURNING MACHINES, BEVEL
Bridgeford Mach. Tool Works, Rochester, N.Y.

GEAR BOXES, REDUCTION
Coventry Chain Co., Coventry, Eng.

GEARS, CUT, MORTISE, ANGLE, WORM
Baxter & Co., Ltd., J. R., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Ltd., Hamilton, Ont.
Goldie & McCulloch Co., Galt, Ont.
Crescent Mach. Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Victoria Foundry Co., Ottawa.
Hull Iron & Steel Foundries, Ltd., Hull, Que.
Illinois Tool Works, Chicago, Ill.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
The Smart-Turner Machine Co., Hamilton, Ont.
Wilson & Co., J. C., Belleville, Ont.

GEAR CUTTER
National Tool Co., Cleveland, Ohio.

GEAR HUB
National Tool Co., Cleveland, Ohio.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal
Grant Gear Works, Boston, Mass.
Crescent Mach. Co., Ltd., Montreal.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Philadelphia Gear Works, Philadelphia, Pa.
A. R. Williams Machy. Co., Toronto.

GENERATORS, ELECTRIC
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

GENERATORS, MOTOR
MacGovern & Co., Montreal, Que.

GERMAN SILVER
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland, Ohio.
Willson & Co., Inc., T. A., Reading, Pa.

GLOVES, WORKMEN'S
Hickory Steel-Grip Glove Co., Chicago, Ill.

GOVERNORS, STEAM AND GASOLINE ENGINE
Pickering Governor Co., Portland, Ore.

GOVERNORS, PUMP
Foster Engineering Co., Newark, N.J.

GOVERNOR, WATER WHEEL
Wilson & Co., J. C., Belleville, Ont.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy & Supplies, Ltd., Montreal, Que.

GOGGLES
Consolidated Optical Co., Toronto, Ont.
Standard Optical Co., Geneva, N.Y.
Strong, Kenard & Nutt Co., Cleveland, Ohio.
Willson & Co., Inc., T. A., Reading, Pa.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASES (SEE LUBRICANTS)

GRINDERS, AUTOMATIC KNIFE
W. H. Banfield & Son, Toronto.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Blake & Johnson Co., Waterbury, Conn.
Can. Machinery Corp., Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
New Britain Machine Co., New Britain, Conn.
Perfect Machine Co., Galt, Ont.
United States Electrical Tool Co., Cincinnati, O.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co. Providence, R.I.
Cincinnati Milling Mach. Co., Cincinnati, Ohio.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Greenfield Machine Co., Greenfield, Mass.
Grand Rapids Grinding Mach. Co., Grand Rapids, Mich.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Norton Grinding Co., Worcester, Mass.
Perfect Machine Co., Galt, Ont.
Pratt & Whitney Co., Dundas, Ont.

GRINDERS, DIE AND CHASER
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Grand Rapids Grinding Mach. Co., Grand Rapids, Mich.
United States Electrical Tool Co., Cincinnati, O.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Grinding Co., Worcester, Mass.
Perfect Machine Co., Galt, Ont.

GRINDERS, EXTERNAL ATTACHMENT
Rivett Lathe & Grinder Co., Boston, Mass.

GRINDERS, KNIFE
Preston Woodworking Machine Co., Preston, Ont.

GRINDERS, PORTABLE, ELECTRIC, HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago, Ill.
United States Electrical Tool Co., Cincinnati, O.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

GRINDERS, HOLE, FACE, DEEP HOLE
Bryant Chucking Grinder Co., Springfield, Ohio.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blake & Johnson Co., Waterbury, Conn.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Ford-Smith Machine Co., Hamilton, Ont.
Grand Rapids Grinding Mach. Co., Grand Rapids, Mich.
Greenfield Machine Co., Greenfield, Mass.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wing & Son, J. E., Hamilton, Ont.

GRINDERS, UNIVERSAL, PLAIN
Grand Rapids Grinding Mach. Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.

GRINDERS, VERTICAL SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Reed-Prentice Co., Worcester, Mass.
Wing & Son, J. E., Hamilton, Ont.
Charles F. Elmes Eng. Works, Chicago.
Gisholt Machine Co., Madison, Wis.

GRINDING MACHINES, BENCH AND FLOOR
St. Louis Mach. Tool Co., St. Louis.

GRINDING MACHINE, RADIAL AND INTERNAL
Rivett Lathe & Grinder Co., Boston, Mass.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John H., Brantford.
LeBlond Mach. Tool Co., R. K., Cincinnati.
Niles-Bement-Pond Co., New York, N.Y.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, SURFACE
Blanchard Machine Co., Cambridge, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Dom. Abrasive Wheel Co., Mimico, Ont.
Canada Emery Wheels Co., Hamilton, Ont.
Ford-Smith Maheine Co., Hamilton, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Norton Co., Worcester, Mass.

GRIT, ANGULAR
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ontario.
New Britain Mach. Co., New Britain, Conn.
Cowan & Co., of Galt, Ltd., Galt, Ont.
Page Steel & Wire Co., Adrian, Mich.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Baxter & Co., Ltd., J. R., Montreal, Que.
Boker & Co., Inc., H., Montreal, Que.
Kayser, Ellison & Co., Ltd., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Ford-Smith Machine Co., Hamilton, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Fry's (London), Ltd., London, England.
Millers Falls Co., Millers Falls, Mass.

Racine Tool & Machine Co., Racine, Wis.
Plewes, Ltd., Winnipeg, Man.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Victor Saw Works, Ltd., Hamilton, Canada.
Wilkinson & Kompass, Hamilton, Ont.
Zenith Coal & Steel Products, Montreal, Que.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York City.
Millers Falls Co., Millers Falls, Mass.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Works, Buffalo, N.Y.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
McKenzie Machy. Co., D., Guelph, Ont.
Peerless Machine Co., Racine, Wis.
Perfect Machine Co., Galt, Ont.
Racine Tool & Mach. Co., Racine, Wis.
L. S. Starrett Co., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto, Ont.

HAMMERS
Canada Foundries & Forgings, Ltd., Welland, Ont.
C. C. Bradley & Son., Inc., Syracuse, N.Y.

HAMMERS, AIR
Erie Foundry Co., Erie, Pa.

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canadian Billings & Spencer Ltd., Welland.
C. C. Bradley & Son., Inc., Syracuse, N.Y.
Canada Machinery Corp., Galt, Ont.
Erie Foundry Co., Erie, Pa.
High Speed Hammer Co., Rochester, N.Y.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Plessisville Foundry Co., Plessisville, Que.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
M. Beatty & Sons, Ltd., Welland, Ont.

HAMMERS, FORGING AND CUSHIONED HELVE
C. C. Bradley & Son., Inc., Syracuse, N.Y.

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
West Tire Setter Co., Rochester, N.Y.

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, MARKING
Matthews, Jas. H. & Co., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston Mass.

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York.

HAMMERS, SHELL NOSING
Beaudry & Company, Inc., Boston, Mass.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie, Ont.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal.
Jones & Glassco, Montreal.
Standard Pressed Steel Co., Philadelphia, Pa.

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York.

HIGH SPEED STEEL
J. F. A. Comstedt, New York City, N.Y.

HIGH SPEED TOOL METAL
Deloro Smelting & Refining Co., Toronto, Ont.
J. F. A. Comstedt, New York City, N.Y.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.
Illinois Tool Works, Chicago, Ill.

HINGES
London Bolt & Hinge Works, London, Ont.

HOBS
Illinois Tool Works, Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

HOBS, MILLING
Butterfield & Co., Rock Island, Que.

HOISTS AND ENGINES FOR CONCRETE MIXERS
St. Clair Bros., Galt, Ont.

HOISTS, AIR
St. Clair Bros., Galt, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

HOISTING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Can. Matthews Gravity Carrier Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
Jones & Glassco, Montreal.
MacGovern & Co., Montreal, Que.
Marsh Engineering Works, Ltd., Belleville, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto, Ont.
Ford Chain Block & Mfg., Philadelphia, Pa.
Independent Pneumatic Tool Co., Chicago, Ill.
Marsh Engineering Works, Ltd., Belleville, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.
Wright Mfg. Co., Lisbon, Ohio.

HOISTING ENGINES
M. Beatty & Sons, Ltd., Welland, Ont.

HOISTS, "MONO RAIL" & STATIONARY
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
Electric Steels & Metals, Ltd., Welland, Ont.
Pollard Mfg. Co., Niagara Falls, Ont.
M. Beatty & Sons, Ltd., Welland, Ont.
Kennedy & Sons, Owen Sound, Ont.
Marsh Engineering Works, Belleville, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS, STEEL DIE FOR MARKING
Matthews, Jas. H., & Co., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland, Ont.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Quebec.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, PNEUMATIC
Baxter & Co., Ltd., J. R., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto, Can.
Independent Pneumatic Tool Co., Chicago, Ill.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, SAND BLAST
Gutta Percha & Rubber, Ltd., Toronto, Can.
Pangborn Corporation, Hagerstown, Md.

HOSE, STEAM
Gutta Percha & Rubber, Ltd., Toronto, Ont.

HYDRAULIC MACHINERY
Garlock-Walker Machinery Co., Toronto, Ont.
Hydraulic Machy. Co., Ltd., Montreal, Que.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDROMETERS
Taylor Instrument Co., Rochester, N.Y.

HYGROMETERS
Taylor Instrument Co., Rochester, N.Y.

HYGRODEIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
L. S. Starrett Co., Athol, Mass.

INDEX CENTRES
Fred C. Dickow, Chicago, Ill.
Garvin Machine Co., New York.

INVENTIONS
Wm. P. McFeat, Power Bldg., Montreal.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INGOT METAL
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
United Brass & Lead Ltd., Toronto.

INGOTS, STEEL
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto, Ont.

IRON ORE
Hanna & Co., M. A., Cleveland, O.

IRON SAND
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

IRON, WROUGHT, ROLLED AND PIG
Swedish Steel & Importing Co., Ltd., Montreal.

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.

JACKS, HYDRAULIC
Charles F. Elmes Eng. Works, Chicago.

JACKS, PNEUMATIC
Northern Crane Works, Walkerville.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto, Ont.
Crescent Mach. Co., Ltd., Montreal.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Homer & Wilson, Hamilton, Ont.
Illinois Tool Works, Chicago, Ill.
Marten Machine Co., Hamilton, Ont.
Normac Machine Co., St. Catharines, Ont.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Ltd., Welland, Ont.

KEY SEATERS
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich.
A. R. Williams Machy. Co., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sheldons, Limited, Galt, Ont.

LABELS AND TAGS
Matthews, Jas. H. & Co., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (SEE CHEMISTS)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LAMPS, INCANDESCENT AND NITROGEN
Can. Laco-Philips Co., Toronto, Ont.

LAMP BRACKETS, UNIVERSAL
The McCroskey Reamer Co., Meadville, Pa.

LAMPS, TUNGSTEN
Can. Laco-Philips Co., Toronto, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.

LATHE CHUCKS (SEE CHUCKS)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Curtis & Curtis Co., Bridgeport, Conn.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.

LATHES, AXLE
Bridgeford Mach. Tool Works, Rochester, N.Y.

LATHES, BORING
Stand. Machy. & Supplies, Ltd., Montreal, Que.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
Blount, J. G., & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Rivett Lathe & Grinder Co., Boston, Mass.
Preston Woodworking Machine Co., Preston, Ont.
Seneca Falls Mfg. Co., Inc.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Hardinge Bros., Chicago, Ill.
New Britain Mach. Co., New Britain, Conn.
Pratt & Whitney Co., Dundas, Ont.

LATHES, BAND TURNING
Roelofson Machine & Tool Co., Toronto, Ont.

LATHES, BORING
Bridgeford Mach. Tool Works, Rochester, N.Y.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Inc., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, Ohio.
John Bertram & Sons Co., Dundas.
Bridgeford Mach. Tool Works, Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Iron & Steel Co., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., Cincinnati, O.
Wickes Bros., Saginaw, Mich.
Seneca Falls Mfg. Co., Inc.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Hamilton Mach. Tool Co., Hamilton, Ohio.
Kennedy & Sons, Wm., Owen Sound, Ont.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Reed-Prentice Co., Worcester, Mass.
Riverside Machinery Depot, Detroit, Mich.
Smalley-General Co., Inc., Bay City, Mich.
Sidney Tool Co., Sidney, Ohio.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Yates Machine Co., P. B., Hamilton, Ont.

LATHES, METAL TURNING
American Tool Works Co., Cincinnati, Ohio.
Fittings, Ltd., Oshawa, Ont.

LATHES, CRANKSHAFT
American Tool Works Co., Cincinnati, Ohio.

LATHES, GUN
American Tool Works Co., Cincinnati, Ohio.

LATHE ATTACHMENTS
Cincinnati Lathe & Tool Co., Cincinnati, O.
The McCroskey Reamer Co., Meadville, Pa.

LATHES, SHELL
Reed-Prentice Co., Worcester, Mass.
W. T. Whitehead, Son & Co., Montreal, Que.

LATHES, JOURNAL TRUEING
Bridgeford Mach. Tool Works, Rochester, N.Y.

LATHES, PATTERNMAKERS'
American Tool Works Co., Cincinnati, Ohio.
Cowan & Co., of Galt, Ltd., Galt, Ont.
J. G. Blount Co., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Geo. F. Foss Mchy. & Supply Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

LATHES, SINGLE PURPOSE
Baxter & Co., Ltd., J. R., Montreal, Que.
Bertram John, & Sons Co., Dundas Ont.
Bridgeford Mach. Tool Works, Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy Co., Toronto, Ont.
Hepburn, John T., Ltd. Toronto.
Plessisville Foundry, Plessisville, Que.
Roelofson Mach. & Tool Co., Toronto, Can.
W. T. Whitehead, Son & Co., Montreal, Que.
Yates Machine Co., P. B., Hamilton, Ont.

LATHES, SCREW CUTTING
Bertram, John, & Sons Co., Dundas, Ont.
Bridgeford Mach. Tool Works, Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Rivett Lathe & Grinder Co., Boston, Mass.
Wickes Bros., Saginaw, Mich.
Seneca Falls Mfg. Co., Inc.
Hepburn, John T., Ltd., Toronto.
Niles-Bement-Pond Co., New York.
Riverside Machinery Depot, Detroit, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
W. T. Whitehead, Son & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

LATHES, SPINNING
Bliss, E. W., Co., Brooklyn, N.Y.
Ferracute Mach. Co., Bridgeton, N.J.
W. T. Whitehead, Son & Co., Montreal, Que.

LATHES, TURRET, HAND, HORIZONTAL
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram, John, & Sons Co. Dundas Ont.
Rivett Lathe & Grinder Co., Boston, Mass.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Foster Machine Co. Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn, John T., Ltd., Toronto.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
Mullmer-Enlund Tool Co., Syracuse, N.Y.
National-Acme Co., Cleveland, Ohio.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Riverside Machinery Depot, Detroit, Mich.
Standard Machy. & Supplies, Ltd., Montreal, Que.
W. T. Whitehead, Son & Co., Montreal, Que.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto.
Wood Turret Mach. Co., Brazil, Ind., U.S.A.

LEAD BURNING
St. Lawrence Welding Co., Montreal, Que.
Canadian Welding Works, Montreal, Que.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, Mass.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LIFTS, PNEUMATIC
Whiting Foundry Equipment Co., Harvey, Ill.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

LINK BELTING
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LITIGATION
Wm. P. McFeat, Power Bldg., Montreal.

LIQUID AIR
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Montreal, Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.

LOADERS, WAGON AND TRUCK
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ontario.

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.
Elm Cutting Oil Co., Toronto, Ont.
Ontario Lubricating Co., Hamilton, Ont.

LUBRICATORS
Trabern Pump Co., Rockford, Ill.

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal, Que.
Baxter & Co., Ltd., J. R., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy Co., Toronto, Ont.
The Geo. N. Foss Mchy. & Supply Co., Montreal.
Standard Machy. & Supplies, Ltd., Montreal, Que.
W. T. Whitehead, Son & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

MACHINERY, STONE-WORKING AND FLOUR-MILLING
Pollard Mfg. Co., Niagara Falls, Ont.

MACHINERY, HAMMER AND NAIL
Garlock-Walker Machinery Co., Toronto, Ont.

MACHINERY GUARDS (SEE GUARDS)

MACHINERY REPAIRS
Allatt Machine & Tool Co., Toronto, Ont.
Crescent Mach. Co., Ltd., Montreal.
Marten Mach. Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Sumbling Mach. Co., W. H., Toronto, Ont.
A. R. Williams Machy. Co., Toronto.

MACHINISTS' SCALES, SMALL TOOLS AND SUPPLIES
Can. Fairbanks-Morse Co., Montreal.
Marten Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
MacGovern & Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
W. T. Whitehead, Son & Co., Montreal, Que.
J. H. Williams & Co., Brooklyn, N.Y.

MACHINE TOOLS
Cincinnati Lathe & Tool Co., Cincinnati, O.

MANDRELS
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Manufacturers Equip. Co., Chicago, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MANDRELS, EXPANDING AND SOLID
W. H. Nicholson & Co., Wilkesbarre, Pa.

MARKING DEVICES
Pritchard-Andrews Co. of Canada, Ottawa, Ont.
Matthews, Jas. H., & Co., Pittsburgh, Pa.

MARINE MACHINERY
Corbet Foundry & Mach. Co., Owen Sound.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Perrin, Wm. R., Toronto.

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURING TAPES AND RULES
James Chesterman & Co., Ltd., Sheffield, Eng.

METALLURGISTS
Can. Inspection & Testing Lab., Montreal, Que.
Toronto Testing Laboratory, Ltd., Toronto.

METAL SAWS
Simonds Mfg. Co., Fitchburg, Mass.

METALS
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
M. & L. Samuel, Benjamin & Co., Toronto.
Can. B. K. Morton, Toronto, Montreal.
Canada Metal Co., Toronto, Ont.
Dom. Iron & Wrecking Co., Ltd., Montreal, Que.
Harvey & Co., Arthur C., Boston, Mass.
Ennshevsky & Son, B., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
United Brass & Lead Ltd., Toronto.

METAL SHAPING MACHINES
Jackson Shaper Co., Jackson, Mich.

METERS, OIL, WATER
Bowser & Co., Inc., S. F., Toronto, Ont.

MICROMETERS
Almond Mfg. Co., T. R., Ashburnham, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Betts Machine Co., Rochester, N.Y.
W. T. Whitehead, Son & Co., Montreal, Que.

MILLING CUTTERS
Cleveland Milling Machine Co., Cleveland, O.
National Tool Co., Cleveland, Ohio.

MILLING ATTACHMENTS
Becker Milling Machine Co., Boston, Mass.
Bertram, John, & Sons Co., Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati.
Cleveland Milling Machine Co., Cleveland, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Fox Machine Co., Jackson, Mich.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Taft-Peirce Mfg. Co., Woonsocket, R.I.
W. T. Whitehead, Son & Co., Montreal, Que.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
United States Mach. Tool Co., Cincinnati, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Steptoe Co., The, John, Cincinnati, Ohio.
W. T. Whitehead, Son, & Co., Montreal, Que.
Whitney Mfg. Co., Hartford, Conn.

MILLING MACHINES, BENCH TYPE
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES
Universal Boring Mach. Co., Hudson, Mass.
Cleveland Milling Machine Co., Cleveland, O.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Becker Milling Machine Co., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence.
Bertram, John, & Sons Co., Dundas Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kempsmith Mfg. Co., Milwaukee, Wis.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Riverside Machinery Depot, Detroit, Mich.
Steptoe, The John Co., Cincinnati, Ohio.
United States Mach. Tool Co., Cincinnati, Ohio.
W. T. Whitehead, Son & Co., Montreal, Que.
Whitney Mfg. Co., Hartford, Conn.
A. R. Williams Machy. Co., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss, The Geo. F., Mchy. & Supply Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
Niles-Bement-Pond Co, New York.
Pratt & Whitney Co., Dundas, Ont.
Steptoe, The John Co., Cincinnati, Ohio.

MILLING MACHINES, PROFILE
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss, The Geo. F., Mchy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Riverside Machinery Depot, Detroit, Mich.
W. T. Whitehead, Son & Co., Montreal, Que.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
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.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Marsh Engineering Works, Belleville, Ont.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Marsh Engineering Works, Belleville, Ont.
A. R. Williams Machy. Co., Toronto.

MITTENS FOR WORKMEN
Hickory Steel-Grip Glove Co., Chicago, Ill.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MODEL WORK
Windsor Mach. & Tool Co., Windsor, Ont.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Preston Woodworking Machine Co., Preston, Ont.
Cowan & Co., of Galt, Ltd., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
New Britain Mach. Co., New Britain, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.

MUNTZ METAL
Brown Copper & Brass Roller Mills, New Toronto, Ont.

NAILS
Page Steel & Wire Co., Adrian, Mich.

NAIL MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pritchard-Andrews Co., Ottawa, Ont.

NICKEL
Boker & Co., Inc., H., Montreal, Que.

NICKEL SILVER
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

NICKEL STEEL
J. F. A Comstedt, New York City, N.Y.
Kayser, Ellison & Co., Ltd., Montreal.

NICKEL, CHROME
Kayser, Ellison & Co., Ltd., Montreal.

NIPPLE HOLDERS
Curtis & Curtis Co., Bridgeport, Conn.

NIPPLE THREADING MACHINES
John H. Hall & Sons, Ltd., Brantford, Ont.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.
L'Air Liquid Society, Montreal, Toronto.

NOZZLES, SPRAY
Spray Engineering Co., Boston, Mass.

NUTS
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Canadian B. K. Morton, Toronto, Montreal.
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
United Brass & Lead Ltd., Toronto.
Wilkinson & Kompass, Hamilton, Ont.

NUT BURRING MACHINES
National Machy. Co., Tiffin, Ohio.

NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Ti..n, Ohio.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram, John, & Sons Co., Dundas Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hall, J. H., & Son, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.

OILS, MOTOR
Elm Cutting Oil Co., Toronto, Ont.

OILS, DRAWING
Elm Cutting Oil Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse, Co., Montreal.
Sheldon's, Ltd., Galt, Ont.
Smart-Turner Machine Co., The, Hamilton.

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL FUSE CUTOUTS
D. & W. Fuse Co., Providence, R.I.

OIL PUMPS FOR STEAM ENGINES
Pickering Governor Co., Portland, Ore.

OIL CUPS, SCREW TOP, HINGE LID
Canadian Winkley Co., Ltd., Windsor.

OIL HOLE COVERS
Canadian Winkley Co., Ltd., Windsor.

OIL STORAGE SYSTEMS
Bowser & Co., Inc., S. F., Toronto, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Can., Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

OVERHEAD CRANES, ETC.
Volta Mfg. Co., Welland, Ont.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Whiting Foundry Equipment Co., Harvey, Ill.

OVENS FOR DRYING, TEMPER AND UNDER TRUCKS
Brantford Oven & Rack Co., Brantford, Ont.

OXY-ACETYLENE WELDING AND CUTTING
Can. Welding Works, Montreal, Que.
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies, Ltd., Montreal, Que.

OXY-ACETYLENE WELDING AND CUTTING PLANT
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Montreal, Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Oxyweld Co., Ltd., Toronto, Ont.
Welding & Supplies, Ltd., Montreal, Que.

OXYGEN (SEE ACETYLENE)
L'Air Liquide Society, Montreal, Que.
Canadian Welding Works, Montreal, Que.

PACKINGS, ASBESTOS
Canadian Welding Works, Montreal, Que.
Cleveland Wire Spring Co., Cleveland.
New Britain Mach. Co., New Britain, Conn.

PACKED COCKS
Pratt & Cady Co., Inc., Hartford, Conn.

PACKINGS, LEATHER, HYDRAULICS, ETC.
Baxter & Co., Ltd., J. R., Montreal, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
Gutta Percha & Rubber, Ltd., Toronto, Can.
William R. Perrin, Ltd., Toronto.

PAINT SPRAYING EQUIPMENT
Spray Engineering Co., Boston, Mass.

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Can. Link-Belt Co., Toronto, Ont.

PAPER MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Hydraulic Machy. Co., Ltd., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Preston Woodworking Machine Co., Preston, Ont.
Cowan & Co., of Galt, Ltd., Galt, Ont.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.

PATENTS
Wm. P. McFeat, Power Bldg., Montreal.

PATTERNMAKERS' BRASS DOWEL PINS
Can. Winkley Co., Ltd., Windsor.

PATENT SOLICITORS
Budden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PATTERNS
Can. Rumley Co., Toronto, Ont.
Dominion Pattern Works, Toronto, Ont.
Crescent Mach. Co., Ltd., Montreal.
Katie Foundry Co., Galt, Ont.
J. C. Wilson & Co., Belleville, Ont.
Greenleafs Ltd., Belleville, Ont.
Marten Machine Co., Hamilton, Ont.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph, Ont.

PIPE CUTTING AND THREADING MACHINES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
A. R. Williams Machy. Co., Toronto.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.

PIPE AND FITTINGS, SOIL
Anthes Foundry, Ltd., Winnipeg.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
John H. Hall & Sons, Ltd., Brantford, Ont.
Wells Bros. Co. of Canada, Galt, Ont.

PIPE FORMING MACHINES
Blashill Wire Machinery Co., Montreal, Que.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, METAL
Cincinnati Planer Co., Cincinnati, O.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
American Tool Works Co., Cincinnati, Ohio.
Preston Woodworking Machine Co., Preston, Ont.
Garvin Machine Co., New York.
Hamilton Machine Tool Co., Hamilton, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
Niles-Bement-Pond Co., New York.
W. T. Whitehead, Son & Co., Montreal, Que.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING MILL WORKS
Can. Rumely Co., Toronto, Ont.
W. T. Whitehead, Son & Co., Montreal, Que.

PLANING AND SHAPING MACHINERY
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Cowan & Co., of Galt, Ltd., Galt, Ont.
Garvin Machine Co., New York.
Hamilton Machine Tool Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Riverside Machinery Depot, Detroit, Mich.
Steptoe, The John Co., Cincinnati, Ohio.
A. R. Williams Machy. Co., Toronto.

PLANING MILL MACHINERY
Preston Woodworking Machine Co., Preston, Ont.

PLANER-SHAPER, COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
W. T. Whitehead, Son & Co., Montreal, Que.

PLIERS
Aikenhead Hardware Co., Toronto.
Canadian Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Conn.
Rice Lewis & Son, Toronto, Ont.

POLISHING CLOTHS
Pullan, E., 20 Maud St., Toronto.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

PRESSED STEEL AND BRASS GREASE CUPS
Can. Winkley Co., Ltd., Windsor.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.

PRESSES, BROACHING, FORGING AND FLANGING
Atlas Press Co., Kalamazoo, Mich.
E. W. Bliss Co., Brooklyn, N.Y.
Ferracute Machine Co., Bridgeton, N.J.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Consolidated Press Co., Hastings, Mich.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES FOR SHELLS
Atlas Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Ferracute Machine Co., Bridgeton, N.J.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Hydraulic Machy. Co., Ltd., Montreal, Que.
Metalwood Mfg. Co., Detroit, Mich.
William R. Perrin, Ltd., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
West Tire Setter Co., Rochester, N.Y.

PRESSES, FILTER
William R. Perrin, Ltd., Toronto.
Shaney-General Co., Inc., Bay City, Mich.

PRESSES, DROP AND FORGING
W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Fairbanks-Morse Co., Montreal.
Erie Foundry Co., Erie, Pa.
Hydraulic Machy. Co., Ltd., Montreal, Que.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.

PRESSES, HYDRAULIC
John Bertram & Sons Co., Dundas.
Hydraulic Machy. Co., Ltd., Montreal, Que.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
West Tire Setter Co., Rochester, N.Y.
A. R. Williams Machy. Co., Toronto.

PRESSES, BALING
William R. Perrin, Ltd., Toronto.

PRESSES, PNEUMATIC
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Consolidated Press Co., Hastings, Mich.
Ferracute Machine Co., Bridgeton, N.J.
Garlock-Walker Machinery Co., Toronto, Ont.
Hydraulic Machy. Co., Ltd., Montreal, Que.
William R. Perrin, Ltd., Toronto.
Riverside Machinery Depot, Detroit, Mich.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
A. R. Williams Machy. Co., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Consolidated Press Co., Hastings, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, SCREW
Barnes, W. F., & John Co., Rockford, Ill.
Bliss Co., E. W., Brooklyn, N.Y.
Ferracute Mach. Co., Bridgeton, N.J.
William R. Perrin, Ltd., Toronto.

PROFILE GRINDERS
Cleveland Milling Machine Co., Cleveland, O.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Consolidated Press Co., Hastings, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Mach. Co., Bridgeton, N.J.
Stoll Co., D. H., Buffalo, N.Y.

PRODUCTION WORK
Crescent Machine Co., Ltd., Montreal.
Windsor Mach. & Tool Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound, 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, R.I.
Can. Fairbanks-Morse Co., Montreal.
Dodge Sales & Eng. Co., Mishawaka, Ind.
Goldie & McCulloch Co., Galt, Ont.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Positive Clutch & Pulley Works, Ltd., Toronto.
J. C. Wilson & Co., Belleville, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
The Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.

PULLEYS, FRICTION CLUTCH
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Works, Ltd., Toronto.
Jones & Glassco, Montreal.
Johnson, Carlyle, Mach. Co., Manchester, Conn.

PULP MILL MACHINERY
Can. Barker Co., Sault Ste. Marie, Ont.
Hydraulic Machy. Co., Ltd., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

PUMPING MACHINERY
Goldie & McCulloch Co., Galt, Ont.

PUMPS, AIR
Goldie & McCulloch Co., Galt, Ont.
Smart-Turner Mach. Co., Hamilton.

PUMPS, CENTRIFUGAL
Goldie & McCulloch Co., Galt, Ont.
Bowser & Co., Inc., S. F., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
M. L. Oberdorfer Brass Co., Syracuse, N.Y.
Pratt & Whitney Co., Dundas, Ont.

Sheldons, Ltd., Galt, Ont.
Smart-Turner Mach. Co., Hamilton.

PUMPS, FUEL OIL
Bowser & Co., Inc., S. F., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
M. L. Oberdorfer Brass Co., Syracuse, N.Y.

PUMPS, HIGH PRESSURE
Hydraulic Machy. Co., Ltd., Montreal, Que.
William R. Perrin, Ltd., Toronto.
Smart-Turner Mach. Co., Hamilton.

PUMPS, ALL KINDS
M. L. Oberdorfer Brass Co., Syracuse, N.Y.
William R. Perrin, Ltd., Toronto.
Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.

PUMPS, HYDRAULIC
Garlock-Walker Machinery Co., Toronto, Ont.
Hydraulic Machy. Co., Ltd., Montreal, Que.
Metalwood Mfg. Co., Detroit, Mich.
Smart-Turner Mach. Co., Hamilton.
William R. Perrin, Ltd., Toronto.

PUMPS, LUBRICANT, OIL, WATER
Bowser & Co., Inc., S. F., Toronto, Ont.
Fry's (London), Ltd., London, England.
M. L. Oberdorfer Brass Co., Syracuse, N.Y.
Trahern Pump Co., Rockford, Ill.

PUMPS, MOTOR AND BELT DRIVEN
MacGovern & Co., Montreal, Que.
M. L. Oberdorfer Brass Co., Syracuse, N.Y.

PUMPS, ROTARY, POWER DRIVEN
Bowser & Co., Inc., S. F., Toronto, Ont.
M. L. Oberdorfer Brass Co., Syracuse, N.Y.
Trahern Pump Co., Rockford, Ill.

PUMPS, SUD
Fry's (London), Ltd., London, England.

PUMP LEATHERS
Can. B. K. Morton, Toronto, Montreal.
Graton & Knight Mfg. Co., Worcester, Mass.

PUNCHES AND DIES
W. H. Banfield & Sons, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Boker & Co., Inc., H., Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Crescent Mach. Co., Ltd., Montreal.
Can. Blower & Forge Co., Kitchener, Ont.
Ferracute Mach. Co., Bridgeton, N.J.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Mulliner-Enlund Tool Co., Syracuse, N.Y.
Marten Machine Co., Hamilton, Ont.
Pratt & Whitney Co., Dundas, Ont.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.

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.
Consolidated Press Co., Hastings, Mich.
Ferracute Mach. Co., Bridgeton, N.J.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Limited, Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Stoll Co., D. H., Buffalo, N.Y.
Wickes & Co., Saginaw, Mich.

PUNCHES, CHROME, VANADIUM SHELL
Hammond Steel Co., Inc., Syracuse, N.Y.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Wickes & Co., Saginaw, Mich.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York.
W. A. Whitney Mfg. Co., Rockford, Ill.

PYROMETERS
Bristol Co., Waterbury, Conn., U.S.A.
Shore Instrument & Mfg. Co., New York City.
Taylor Instrument Co., Rochester, N.Y.
Thwing Instrument Co., Philadelphia, Pa.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

QUARTERING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAILING, IRON AND BRASS
Can. Welding Works, Montreal, Que.
United Brass & Lead, Ltd., Toronto, Ont.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.
Niles-Bement-Pond Co., New York.

RADIAL DRILLING MACHINE, WALL
Lynd-Farquhar Co., Boston.
Wickes & Co., Saginaw, Mich.

RADIAL DRILLS
American Tool Works Co., Cincinnati, Ohio.
Mueller Machine Tool Co., Cincinnati, O.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York.

RAIL OVERHEAD
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

RATCHETS
Keystone Mfg. Co., Buffalo, N.Y.

RAW HIDE PINIONS (SEE GEARS)

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
The McCrosky Reamer Co., Meadville, Pa.
The Kelly Reamer Co., Cleveland, O.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIPE, CYLINDER AND LOCOMOTIVE
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Kelly Reamer Co., Cleveland, O.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Aikenhead Hardware Co., Toronto.
Baxter & Co., Ltd., J. R., Montreal, Que.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
The McCrosky Reamer Co., Meadville, Pa.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McKenna Brothers, Pittsburgh, Pa.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Illinois Tool Works, Chicago, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.

RECORDING INSTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland, Ont.

REGULATORS, PRESSURE TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

RIVETS, TUBULAR, BIFURCATED
Parmenter & Bulloch Co., Gananoque.
Rice Lewis & Son, Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

RIP SAW MACHINERY
Preston Woodworking Machine Co., Preston, Ont.

RIVETS, IRON, COPPER AND BRASS
Aikenhead Hardware Co., Toronto, Ont.
Harvey & Co., Arthur C., Boston, Mass.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

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, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport, Conn.
High-Speed Hammer Co., Rochester, N.Y.
F. B. Shuster Co., New Haven, Conn.

RODS
General Steel Co., Milwaukee.
Page Steel & Wire Co., Adrian, Mich.

ROLLER CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

ROLLS, BENDING AND STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland, Ont.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

RUBBER MILL DRIVES
Can. Link-Belt Co., Toronto, Ont.

RUBBER MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

RUBBER GOODS
Dunlop Tire & Rubber Co., Toronto.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.
L. S. Starrett Co., Athol, Mass.

SAND BLAST GLOVES
Hickory Steel-Grip Glove Co., Chicago, Ill.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland, Ohio.

SAFETY APPLIANCE GOGGLES
Willson Co., Inc., T. A., Reading, Pa.

SAND BLAST ABRASIVES
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANDING MACHINES
Canada Machinery Corp., Galt, Ont.
Cowan & Co., of Galt, Ltd., Galt, Ont.

SAND BLASTING MACHINES
Richards Sand Blasting Machine Co., Montreal.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Preston Woodworking Machine Co., Preston, Ont.
Cowan & Co., of Galt, Ltd., Galt, Ont.
Gardner, Robt., & Son, Montreal.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
A. R. Williams Machy. Co., Toronto.

SASH WEIGHTS AND WRENCHES
Fittings, Ltd., Oshawa, Ont.

SAWS, CIRCULAR METAL
E. C. Atkins & Co., Indianapolis, Ind.
Plewes, Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburg, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (SEE HACK SAWS)
E. C. Atkins & Co., Indianapolis, Ind.
Hunter Saw & Mach. Co., Pittsburgh, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, SLITTING
E. C. Atkins & Co., Indianapolis, Ind.
Taylor, J. A. M., Stair Bldg., Toronto, Ont.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York City.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland, O.

SCREW MACHINE PRODUCTS
Galt Machine Screw Co., Galt, Ont.
Knight Metal Products, Ltd., Toronto, Ont.
United Brass & Lead, Ltd., Toronto.
Wentworth Mfg. Co., Hamilton, Ont.

SCREW MACHINES, HAND, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Rivett Lathe & Grinder Co., Boston, Mass.
Garvin Machine Co., New York.
A. B. Jardine & Co., Hespeler.
National Acme Co., Cleveland, Ohio.
New Britain Machine Co., New Britain, Conn.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto.
Wood Turret Mach. Co., Brazil, Ind., U.S.A.

SCREW MACHINES, AUTOMATIC MULTIPLE SPINDLE
National Acme Co., Cleveland, Ohio.
Cincinnati Automatic Mach. Co., Cincinnati, O.
New Britain Machine Co., New Britain, Conn.
Riverside Machinery Depot, Detroit, Mich.

SCREWS
Can. B. K. Morton, Toronto, Montreal.
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
United Brass & Lead Ltd., Toronto.
Wilkinson & Kompass, Hamilton, Ont.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Wilkinson & Kompass, Hamilton, Ont.

SCREW SLOTTERS
Garvin Machine Co., New York.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.

SCRAP METAL
Pullan, E., 20 Maud St., Toronto.

SEARCHES
Wm. P. McFeat, Power Bldg., Montreal.

SECOND-HAND MACHINERY
The Geo. F. Foss Machy. & Supply Co., Montreal.
Riverside Machinery Depot, Detroit, Mich.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto, Ont.
Allen Mfg. Co., Hartford, Conn.
Bristol Co., Waterbury, Conn., U.S.A.
Wilkinson & Kompass, Hamilton, Ont.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
American Tool Works Co., Cincinnati, Ohio.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Hamilton Mach. Tool Co., Hamilton, Ohio.
Rhodes Mfg. Co., Hartford, Conn.
Steptoe Co., John, Cincinnati, Ohio.
W. T. Whitehead, Son & Co., Montreal, Que.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton, Ont.

Pratt & Whitney Co., Dundas, Ont.
Rice, Lewis & Son, Toronto, Ont.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Wilson & Co., J. C., Belleville, Ont.

SHARPENING STONES
Norton Co., Worcester, Mass.
Rice, Lewis & Son, Toronto, Ont.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas
Bertrams, Ltd., Edinburgh, Scotland
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York
Toledo Machine & Tool Co., Toledo

SHEARS, POWER
John Bertram & Sons Co., Dundas
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Ferracute Machine Co., Bridgeton, N.J.
Garlock-Walker Machinery Co., Toronto, Ont.
Wickes & Co., Saginaw, Mich.
A. B. Jardine & Co., Limited, Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York
Stoll Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo

SHEARS, PNEUUMATIC
Toledo Machine & Tool Co., Toledo, Ohio.

SHEETS, BLACK AND GALVANIZED
M. & L. Samuel, Benjamin & Co., Toronto.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Canada
Stoll Co., D. H., Buffalo, N.Y.

SHEET METALS
M. & L. Samuel, Benjamin & Co., Toronto.

SHEET METAL WORK
Can. Rumely Co., Toronto, Ont.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Peck, Stow & Wilcox, Southington, Conn.
Steel Bending Brake Works, Ltd., Chatham, Ont.
Stoll Co., D. H., Buffalo, N.Y.

SHEET METAL STAMPINGS
Dominion Forge & Stpg. Co., Walkerville, Ont.

SHEET METAL WORKING MACHINERY
Stoll Co., Inc., D. H., Buffalo, N.Y.

SHELVING, STEEL
Dennis Wire & Iron Works, London, Ontario.

SHELL FINISHING TOOLS
National Tool Co., Cleveland, Ohio.

SHELL BANDING MACHINES, HYDRAULIC
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., W. R., Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.

SHELL PAINTING MACHINES
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

SHELL RIVETERS
Grant Mfg. & Machine Co., Bridgeport, Conn.
High Speed Hammer Co., Rochester, N.Y.

SHOP FURNITURE
Dennis Wire & Iron Works, London, Ontario.
New Britain Mach. Co., New Britain, Conn.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
Can. B. K. Morton, Toronto, Montreal.
Williams & Co., J. H., 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.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilkinson & Kompass, Hamilton, Ont.

SLINGS, CHAIN
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York
Rhodes Mfg. Co., Hartford, Conn.

SMOKESTACKS
Canadian Welding Works, Montreal, Que.
Marsh Engineering Works, Belleville, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass
Rice, Lewis & Son, Toronto, Ont.

SOCKET HEAD CAP SCREWS
Allen Mfg. Co., Hartford, Conn.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Canada
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
United Brass & Lead Ltd., Toronto

SOLDER
Aikenhead Hardware Co., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
United Brass & Lead, Ltd., Toronto.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal, Que.
Cleveland Wire Spring Co., Cleveland.
Garlock-Walker Machinery Co., Toronto, Ont.
Jas. Steele, Ltd., Guelph, Ont.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Banfield, W. H., & Sons, Toronto.
Beaver Engineering Co., Montreal, Que.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Crescent Mach. Co., Ltd., Montreal.
J. C. Wilson & Co., Belleville, Ont.
Cowan & Co., of Galt, Ltd., Galt, Ont.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont.
Can. Barker Co., Sault Ste. Marie, Ont.
Can. Rumely Co., Toronto, Ont.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ferracute Mach. Co., Bridgeton, N.J.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Courtland, N.Y.
John H. Hall & Sons, Brantford.
Hydraulic Machy. Co., Ltd., Montreal, Que.
A. B. Jardine & Co., Hespeler, Ont.
National-Acme Co., Cleveland, Ohio.
Mulliner & Enlund Tool Co., Syracuse, N.Y.
Marten Machine Co., Hamilton, Ont.
Reed-Prentice Co, Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Smart-Turner Machine Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
Welland Motor & Machine Co., Welland, Ont.
Wilson & Co., J. C., Belleville, Ont.
William R. Perrin, Ltd., Toronto.
Windsor Mach. & Tool Co., Windsor, Ont.

SPECIAL TOOLS
National Tool Co., Cleveland, Ohio.
Cleveland Milling Machine Co., Cleveland, O.

SPRAY COOLING EQUIPMENT
Spray Engineering Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.
Sleeper & Hartley, Inc., Worcester, Mass.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Wilson & Co., J. C., Belleville, Ont.

SPROCKET WHEELS, CAST
Can. Link-Belt Co., Toronto, Ont.
Perrin, Wm. R., Toronto.
Wilson & Co., J. C., Belleville, Ont.

STAIRS, IRON
Can. Welding Works, Montreal, Que.
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM and STEEL
Dom. Forge & Stamping Co., Walkerville, Ont.
Homer & Wilson, Hamilton, Ont.
Wentworth Mfg. Co., Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Canada Machinery Corp., Galt, Ont.
Ferracute Mach. Co., Bridgton, N.J.
Noble & Westbrook Mfg. Co., Hartford, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Matthews, Jas. H. & Co., Hartford, Conn.
Pritchard-Andrews Co., Ottawa, Can.

STAPLE MACHINES
Sleeper & Hertley, Inc., Worcester, Mass.

STARS, WHITE IRON
Katie Foundry Co., Galt, Ont.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.
Canadian Morehead Co., Woodstock, Ont.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

STEEL, CRUCIBLE TOOL
Hammond Steel Co., Inc., Syracuse, N.Y.
Harvey & Co., Arthur C., Boston, Mass.
Illingworth Steel Co., John, New York, N.Y.
Vulcan Crucible Steel Co., Aliquippa, Pa.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Canada, Montreal, Que.
Boker & Co., Inc., H., Montreal, Que.
Can. B. K. Morton, Toronto, Montreal.
Firth & Sons, Thos., Montreal, Que.
Latrobe Electric Steel Co., Latrobe, Pa.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.
Zenith Coal & Steel Products, Montreal, Que.

STEEL CASTINGS
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Can. Brakeshoe Co., Sherbrooke, Que.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.
Swedish Crucible Steel Co., Windsor, Ont.

STEEL, COLD ROLLED
Can. Drawn Steel Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL DRUMS
Smart-Turner Machine Co., Hamilton, Ont.

STEEL DERRICKS
Pollard Mfg. Co., Niagara Falls, Ont.

STEEL PRESSURE BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

STEEL, NICKEL
Firth & Sons, Thos., Montreal, Que.
Harvey & Co., Arthur C., Boston, Mass.
Vulcan Crucible Steel Co., Aliquippa, Pa.

STEEL FORGING BILLETS
Andrews Steel Co., Newport, Ky.

STEEL, HIGH SPEED
Armstrong Whitworth of Canada, Ltd., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Kayser, Ellison & Co., Ltd., Montreal.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
H. A. Drury Co., Ltd., Montreal.
Marshall & Co., Geo., Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., John, New York, N.Y.
Latrobe Electric Steel Co., Latrobe, Pa.
Plewes, Ltd., Winnipeg, Man.
Rice Lewis & Son, Toronto, Ont.
Standard Alloys Company, Pittsburgh, Pa.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.; represented in Canada by Norton, Callard & Co., Montreal, Que.
Zenith Coal & Steel Products, Montreal, Que.

STEEL, GRIT
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL, CHROME AND MANGANESE
Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York, N.Y.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL FOR AXES, ETC.
Kayser, Ellison, & Co., Ltd., Montreal.

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.

STEEL, SPECIAL ELECTRIC ALLOY
Hammond Steel Co., Inc., Syracuse, N.Y.

STELLITE, HIGH-SPEED TOOL METAL
Deloro Smelting & Refining Co., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie, Ont.

STEEL, VANADIUM
Armstrong, Whitworth of Canada, Montreal, Que.
Drury, H. A., Co., Montreal, Que.
Standard Alloys Co., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
New Britain Machine Co., New Britain, Conn.

STOCKS, PIPE
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Limited, Hespeler, Ont.
Rice, Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.

STOOLS, STEEL, SHOP
New Britain Machine Co., New Britain, Conn.

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Page Steel & Wire Co., Adrian, Mich.

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TACK (DOUBLE POINT) MACHINES
Sleeper & Hartley, Inc., Worcester, Mass.

TANKS, GASOLINE AND OIL
Bowser & Co., Inc., S. F., Toronto, Ont.
Canadian Welding Works, Montreal, Que.
Dominion Bridge Co., Montreal, Quebec.
Dominion Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
Marsh Engineering Works, Belleville, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies, Ltd., Montreal, Que.

TANKS, STEEL, WATER PRESSURE
Bowser & Co., Inc., S. F., Toronto, Ont.
Can. Welding Works, Montreal, Que.
Dominion Bridge Co., Montreal, Quebec.
Goldie & McCulloch Co., Galt, Ont.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Marsh Engineering Works, Belleville, Ont.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd., Toronto.
Welding & Supplies, Ltd., Montreal, Que.

TANK WAGONS
Canadian Welding Works, Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd., Toronto.
Welding & Supplies, Ltd., Montreal, Que.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice, Lewis & Son, Toronto, Ont.

TAPPING MACHINES (PENUMATIC)
Cleveland Pneumatic Tool Co. of Can., Toronto.

TAPPING DEVICES
The McCrosky Reamer Co., Meadville, Pa.

TAPPING MACHINES, BENCH TYPE
Burke Machine Tool Co., Conneaut, O.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John, & Sons Co., Dundas.

Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Manufacturers Equipment Co., Chicago, Ill.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.
Bicknell-Thomas Co., Greenfield, Mass.
St. Louis Mach. Tool Co., St. Louis.

TAPPING CHUCKS
St. Louis Mach. Tool Co., St. Louis.

TAPS, ADJUSTABLE
Baxter Co., Ltd., J. R., Montreal, Que.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Manufacturers Equipment Co., Chicago, Ill.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Victor Tool Co. Waynesboro, Pa.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Geometric Tool Co., New Haven.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Rice, Lewis & Son, Toronto, Ont.
L. S. Starrett Co., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.

TAP EXTENSIONS
Allen Mfg. Co., Hartford, Conn.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

THERMOMETERS, INDUSTRIAL
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, ENGRAVED
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.

TESTING INSTRUMENTS METALLURGICAL
Shore Instrument & Mfg. Co., New York City

TESTING LABORATORIES
Can. Inspection & Testing Lab., Montreal, Que.
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont
Geometric Tool Co., New Haven.
A. B. Jardine & Co., Limited, Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co. of Canada, Galt, Ont.

THREADING TOOLS
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Smalley-General Co., Inc., Bay City, Mich.

THREAD MILLING CUTTERS
National Tool Co., Cleveland, Ohio.

THUMB SCREWS AND NUTS
Canada Foundries & Forgings, Ltd., Welland, Ont.
United Brass & Lead Ltd., Toronto
Williams & Co., J. H., Brooklyn, N.Y.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.

TINPLATE
M. & L. Samuel, Benjamin & Co., Toronto.

TIRE BENDERS
A. B. Jardine & Co., Limited, Hespeler, Ont.

TIRE SETTING MACHINES, HYDRAULIC
William R. Perrin, Ltd., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Armstrong Bros. Tool Co., Chicago.
Can. B. K. Morton, Toronto, Montreal.
Deloro Smelting & Refining Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice, Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL CASES
Mechanics' Tool Case Co., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Union Tool Chest Works, Rochester, N.Y.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton.

TOOL STEEL
Armstrong, Whitworth, Ltd. of Canada, Montreal
Atkins & Co., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Deloro Smelting & Refining Co., Toronto, Ont
General Steel Co., Milwaukee, Wis.
H. A. Drury Co., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hammond Steel Co., Inc., Syracuse, N.Y.
Harvey & Co., Arthur C., Boston, Mass.
Hawkridge Bros. Co., Boston, Mass.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall & Co., Geo., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Limited, Hespeler, Ont.
Rice, Lewis & Son, Toronto, Ont.

TOOLS, ADJUSTABLE BORING
The Kelly Reamer Co., Cleveland, O.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago, Ill
Stow Mfg. Co., Binghamton, N.Y.
A. R. Williams Machinery Co., Toronto.
United States Elec. Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.

TOOLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, THREAD CUTTING
Rivett Lathe & Grinder Co., Boston, Mass.

TORCHES, STEEL
Armstrong, Whitworth of Canada, Ltd., Montreal
Prest-O-Lite Co., Inc., Toronto, Ont.

TRACK, PORTABLE STEEL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

TRACK SYSTEMS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

TRANSFORMERS
MacGovern & Co., Montreal, Que.

TRADE MARKS
Wm. P. McFeat, Power Bldg., Montreal.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
A. R. Williams Machinery Co., Toronto.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Coventry Chain Co., Coventry, England.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
J. C. Wilson & Co., Belleville, Ont.
The Smart-Turner Machine Co., Hamilton

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke, Que.
Wilson & Co., J. C., Belleville, Ont.

TRANSMISSION TOWERS
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Dominion Bridge Co., Montreal, Quebec.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton

TRAPS, STEAM
Canadian Morehead Mfg. Co., Woodstock, Ont.

TROLLEYS
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TRUCKS, FACTORY, FREIGHT, ETC.
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing Co., Toronto.
Cowan & Co., of Galt, Ltd., Galt, Ont.
Rice, Lewis & Son, Toronto, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS, LUMBER AND KILN
Sheldons, Ltd., Galt, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Northern Crane Works, Walkerville.

TUBING, SEAMLESS, BRASS & COPPER
Standard Tube & Fence Co., Woodstock, Ont
Tallman Brass and Metal Co., Hamilton, Ont.

TUBING COILERS, FLEXIBLE METAL
Almond Mfg. Co., T. R., Ashburnham, Mass
Sleeper & Hartley, Inc., Worcester, Mass.

TUNGSTEN FILAMENT COILING MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

TURRET MACHINES
Brown & Sharpe Mfg. Co., Providence
Garlock-Walker Machinery Co., Toronto, Ont.
New Britain Machine Co., New Britain, Conn.
Pratt & Whitney, Hartford, Conn.

TURBINES, HORIZONTAL
Wilson & Co., J. C., Belleville, Ont.

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.
Riverside Machinery Depot, Detroit, Mich.

TURRET TOOL POSTS
McCrosky Reamer Co., Meadville, Pa.

TURNBUCKLES
Canada Foundries & Forgings, Ltd., Welland, Ont
Rice, Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

UPSETTING AND BENDING MACHINERY
John Bertram & Sons Co., Dundas
Brown, Boggs Co., Ltd., Hamilton, Canada
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
A. R. Williams Machy. Co., Toronto.

VALVES
Pratt & Cody Co., Inc., Hartford, Conn.

VALVE LEATHERS
Can. B. K. Morton, Toronto, Montreal.
Graton & Knight Mfg. Co., Montreal.

VALVES, PRESSURE, REGULATING AND REDUCING
Foster Engineering Co., Newark, N.J.

VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto

VALVES, PRESSURE RELIEF
Foster Engineering Co., Newark, N.J.

VALVES, FOOT
Smart-Turner Machine Co., Hamilton, Ont.

VALVES, BACK PRESSURE
Foster Engineering Co., Newark, N.J.

VALVES, HYDRAULIC
Metalwood Mfg. Co., Detroit, Mich.

VALVES, ATMOSPHERIC RELIEF
Foster Engineering Co., Newark, N.J.

VALVES, FLOAT
Foster Engineering Co., Newark, N.J.

VANADIUM STEEL
J. F. A. Comstedt, New York City, N.Y.

VENTILATING APPARATUS
Brantford Oven & Rack Co., Brantford, Ont.
Can. Blower & Forge Co., Kitchener, Ont
Sheldons, Limited, Galt, Ont.
A. R. Williams Machy. Co., Toronto.

VISE STANDS, PORTABLE
New Britain Machine Co., New Britain, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

VISES, BENCH
Aikenhead Hardware Co., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass
The Geo. F. Foss Mchy. & Supply Co., Montreal
New Britain Machine Co., New Britain, Conn.

VISES, PIPE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Wells Bros. Co. of Canada, Galt, Ont.
J. H. Williams & Co., Brooklyn, N.Y.

VISES, PLANER AND SHAPER
Aikenhead Hardware Co., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.

WASHER MACHINES
National Machy. Co., Tiffin, Ohio.

WASHERS
Barnes, Wallace, Co., Bristol, Conn.
Graton & Knight Mfg. Co., Worcester, Mass.
Leather Products of Canada, Hamilton, Ont.
London Bolt & Hinge Works, London, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WASTE
United Brass & Lead Ltd., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Wood Turret Machine Co., Brazil, Ind
Pullan, E., Toronto, Ont.

WATER-INTAKE SCREENS
Can. Link-Belt Co., Toronto, Ont.

WATER CINDER MILLS
Whiting Foundry Equipment Co., Harvey, Ill.

WATER JACKETS
Can. Welding Works, Montreal, Que.

WATER TOWERS
Toronto Iron Works, Ltd., Toronto.

WELDING, ELECTRIC, SPOT, BUTT, ETC.
St. Lawrence Welding Co., Montreal, Que.

WELDING MASKS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

WELDERS, ELECTRIC, SPOT, BUTT, ETC.
Tabor Mfg. Co., Philadelphia, Pa.

WELDING RODS AND WIRE
Page Steel & Wire Co., Adrian, Mich.

WELDING, WORK AND SUPPLIES
(Antogenous and Oxy-Acetylene) see OXY-ACETYLENE

WHEELS, SPROCKET AND TRACTION
Can. Link-Belt Co., Toronto, Ont.

WHEEL TRUEING TOOLS
Anderson & Co., of Canada, Geo., Montreal, Que.
Wheel Trueing Tool Co., Windsor, Ont.

WINCHES
John H. Hall & Sons, Brantford.
Kennedy & Son, Wm., Owen Sound, Ont.
M. Beatty & Sons, Ltd., Welland, Ont.
Marsh Engineering Works, Belleville, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

WIPERS, COTTON AND WOOL
Pullen, E., 20 Maud St., Toronto

WIRE, ASBESTOS, INSULATED
D. & W. Fuse Co., Providence, R.I.

WIRE COILING AND POINTING MACHINERY
Baird Machine Co., Bridgeport, Conn.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

WIRE CLOTH AND PERFORATED METALS
Canada Wire & Iron Goods Co., Hamilton.
Page Steel & Wire Co., New York, N.Y.

WIRE FORMING AND STAMPING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Canada
F. B. Shuster Co., New Haven, Conn.

WIRE NAILS
Page Steel & Wire Co., New York, N.Y.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE NAIL MACHINERY
National Machy. Co., Tiffin, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Page Steel & Wire Co., New York, N.Y.

WIRE SPRING
Page Steel & Wire Co., Adrian, Mich.

WIRE SILVER STEEL
Kayser, Ellison, & Co., Ltd., Montreal.

WIRE STEEL, BRASS, COPPER, BRONZE
Page Steel & Wire Co., New York.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE RAILS
Sleeper & Hartley, Inc., Worcester, Mass.

WIRE, MUSIC
Boker & Co., Inc., H., Montreal, Que.

WIRE DRAWING MACHINES

WIRE FENCE MACHINES
Blashill Wire Machinery Co., Montreal, Que.
Blashill Wire Machinery Co., Montreal, Que.

WOOD BORING MACHINES
Canada Machinery Corp., Galt, Ont.
Cowan & Co., of Galt, Ltd., Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.

WIRE STRAIGHTENERS AND CUTTERS
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Canada.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

WORKS STANDS, PORTABLE
New Britain Mach. Co., New Britain, Conn.

WRENCH, CHUCKS
Thomas Elevator Co., Chicago, Ill.

WRENCHES
Williams & Co., J. H., Brooklyn, N.Y.
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Rock Island, Que.
Canada Foundries & Forgings, Ltd., Welland, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Wells Bros. of Canada, Galt, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

WOODWORKING MACHINERY
Preston Woodworking Machine Co., Preston, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Cowan & Co., of Galt, Ltd., Galt, Ont.
New Britain Machine Co., New Britain, Conn.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machy. Co., Toronto.

WOVEN STEEL PARTITIONS
Page Steel & Wire Co., Adrian, Mich.

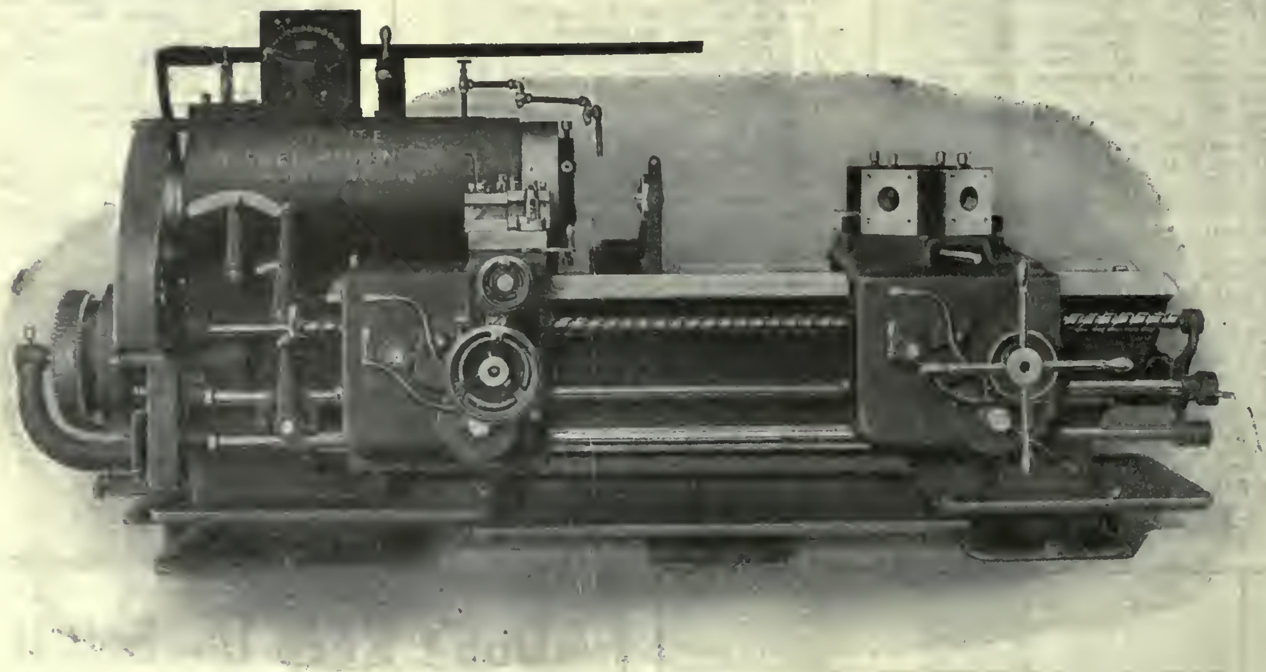
WORK GLOVES
Hickory Steel-Grip Glove Co., Chicago, Ill.

WRENCHES, AUTOMOBILE NARROW JAW AND MONKEY
Bemis & Call Hdwe. & Tool Co., Springfield, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

WRENCHES, PIPE, MONKEY, TAP
Aikenhead Hardware Co., Toronto, Ont.
Bemis & Call Hdwe. & Tool Co., Springfield, Mass.
Peck, Stow & Wilcox Co., Southington, Conn.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
Bemis & Call Hdwe. & Tool Co., Springfield, Mass.
Keystone Mfg. Co., Buffalo, N.Y.

WRENCHES, SOCKET
Allen Mfg. Co., Hartford, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
A. R. Williams Machy. Co., Toronto
Williams & Co., J. H., Brooklyn, N.Y.

WRENCHES, SCREW
Fittings, Ltd., Oshawa, Ont.



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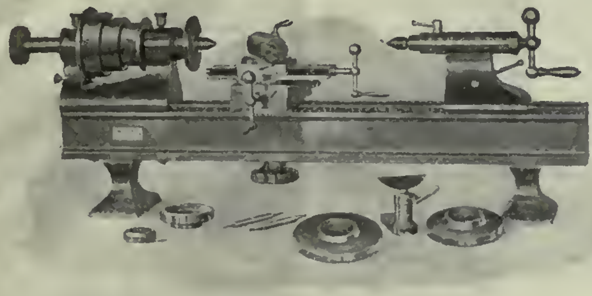
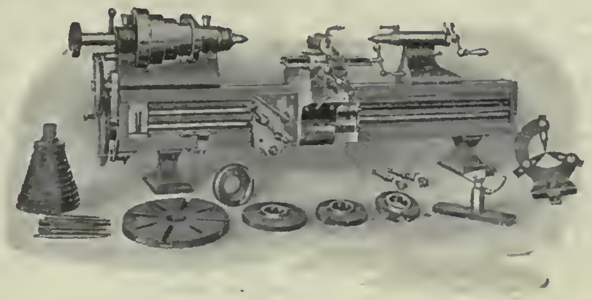
Plain Precision Bench Lathes—Back Geared Precision Lathes—Precision Turret Lathes



No. 504. Plain Precision Lathe

8" swing. 18" between centers. Wire chuck capacity, ⅝" dia. This lathe is designed for simple but accurate tool room and manufacturing work, and it may be equipped with attachments for a large variety of operations, such as screw cutting, milling, grinding, etc. The lathe is finely finished all over.

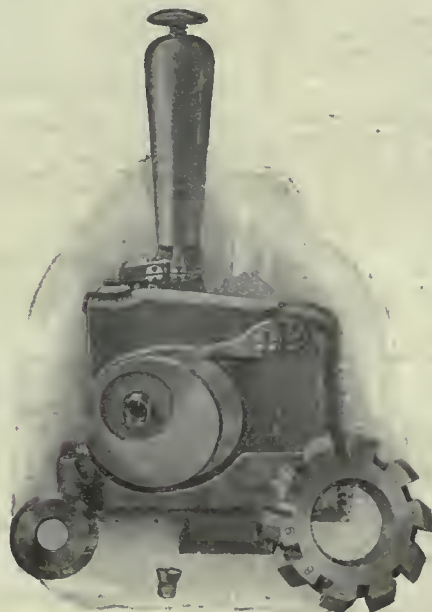


No. 505. Plain Precision Bench Lathe

8" swing. 18" between centers. Wire chuck capacity, ⅞" dia. This lathe is of heavier construction than the No. 504, and is suitable for light manufacturing work where accuracy and speed are essential. It was designed primarily for plain turning and allied work; consequently, attachments which may be supplied are limited. It is finished only on bearing surfaces—other surfaces being well painted.

No. 608. Back Geared Precision Lathe

8½" swing. 20" between centers. Wire chuck capacity, ⅝" dia. This lathe is designed for most accurate tool room, experimental and model room and manufacturing work. It may be equipped with a multitude of attachments for a wide range of work. This lathe, as well as the other bench lathes, may be mounted on combination oil pan and stand, or oak cabinet, and may be either belt or direct motor driven.



Illustrating Method of Mounting Cutting Tool

The Improved Tool facilitates Cutter indexing, provides minimum operating-lever travel with positive lock and makes possible finer adjustment of the cutting-tool. All moving parts are adjustable for wear, cutters are quickly and rigidly mounted with extreme accuracy and the tool may be quickly mounted on the lathe.

RIVETT LATHES

are Accurate

Illustration on left shows No. 705. Precision Hand Turret Lathe

8" swing. Maximum distance between chuck face and turret face, 17¾". Travel of turret slide, 4". Wire chuck capacity, ⅞" dia. This machine is designed for turret work where the production does not warrant the purchase of a full automatic turret lathe. It is easily set up for a large variety of work and can be operated with great rapidity.

THE RIVETT LATHE & GRINDER CO.

BRIGHTON DISTRICT OF BOSTON

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